Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING · PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

MARCH, 1960

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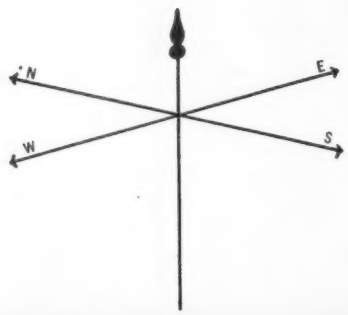
Read and pass on—



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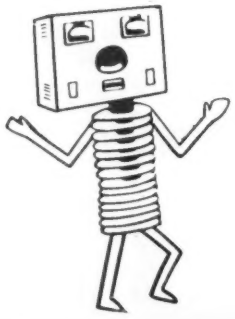

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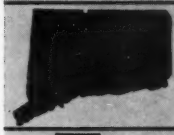

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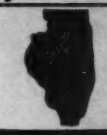

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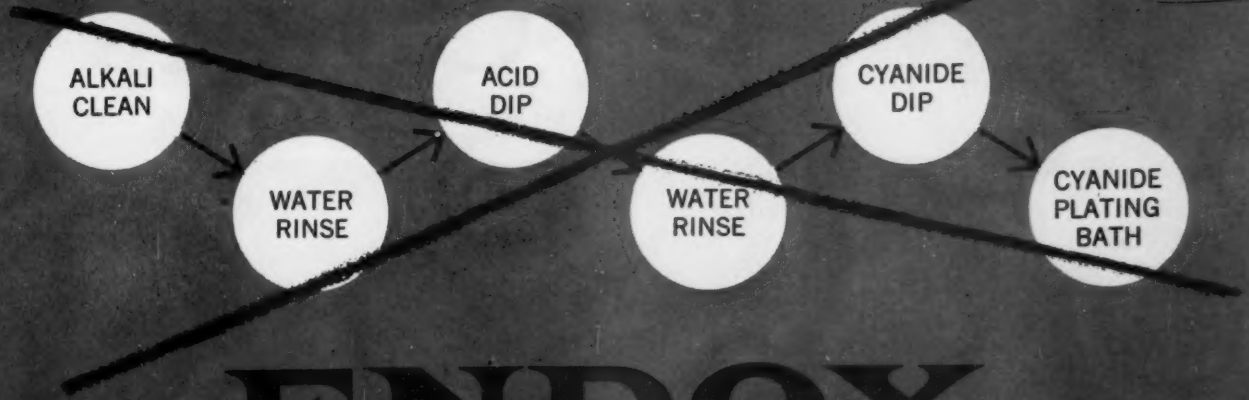

ENDOX

the PATENTED alkaline deoxidizing process prepares steel for plating in one simple step!

In one, simple electrolytic operation, Endox completely removes rust, scale, smut, soil and oxides from steel and activates it for plating. On work that has been precleaned to remove heavy solid soils, no alkali cleaner, acid dip or cyanide dip are required. Endox replaces them all and gives superior plate adhesion, especially on difficult-to-activate alloy steels. Acid attack and acid fumes are eliminated by use of this room-temperature, alkaline process.

Endox cuts rinse water volume (and rinse water waste treatment costs) way down since there's only one brief rinse in the entire cycle prior to plating in a cyanide plating bath. Endox solutions contain sodium cyanide and are compatible with all cyanide plating solutions.

Endox also produces excellent results prior to acid plating baths. It has solved many problems involving adhesion of nickel plate to malleable iron and alloy steel parts which are later subjected to stress. Prior to acid plating, however, the alkaline Endox residue should be neutralized by a dilute acid dip or "sour rinse".

Endox can be used in both barrel and rack plating lines. Endox solutions are very economical to use because they can be maintained indefinitely by periodic analysis and replenishment, just like a plating bath.

Enthone pioneered alkaline deoxidizing and derusting and first introduced such techniques in 1951. In recognition of this, Patent No. 2,915,444 has been awarded to Enthone. Benefit from our long experience in alkaline pickling; write for literature on Endox and the name of your nearest Enthone representative who will be glad to process sample parts for you. Enthone, Inc., 442 Elm Street, New Haven, Connecticut.

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A Subsidiary of American Smelting and Refining Company

To get the finest finish

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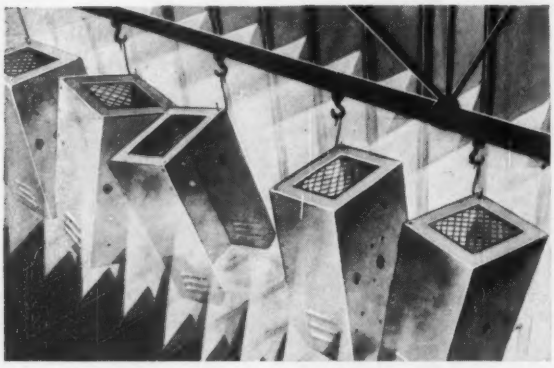
OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

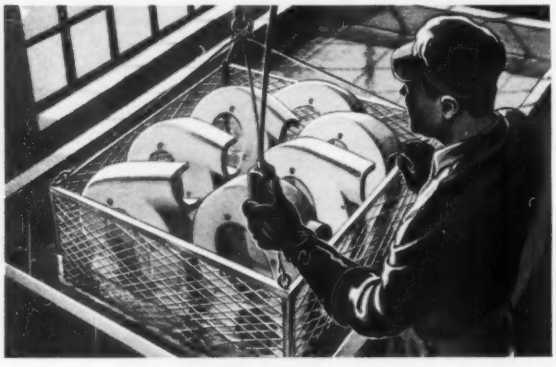


For under-paint steel protection: 7 types of CrysCoat zinc and iron phosphate coatings

Lock paint on . . . lock corrosion out by specifying a CrysCoat cleaning and phosphating process that's job matched to product needs. Seven types give you a choice of tank or spray application . . . the proper degree of protection . . . smooth, serviceable finish . . . low unit cost . . . operating economies.

For barrel finishing, cutting, burnishing: "media-matched" Oakite compounds

Proper barrel mix takes into account not only the work and media, but compounds, too. The *right* compound helps you get a smoother finish, or faster cutting, or tighter tolerances. In the Oakite line, there are compounds for steel, brass, aluminum, zinc, lead and various alloys . . . for hard water and soft.



For pre-paint aluminum protection: Chromi-Coat conversion coating

Oakite ChromiCoat gives a conversion coating that grips paint tightly, protects against corrosion *several times longer* than MIL-C-5541 requires. Gives uniform coatings every time. Easy to control. Economical, too, in initial cost and in "mileage" of solution.

For reverse current cleaning of any metals: a complete line of electrocleaning materials

Best cleaning from your particular facilities, and for the basis metals you're working with are guaranteed with the proper material from the Oakite line of modern electrocleaners. There are materials for heavy-duty cleaning . . . problem soils . . . difficult metals . . . hard water. The right one leads to better finishes, fewer rejects.

Oakite technical service will assure you the *best* choice of material for your needs . . . in barrel finishing . . . in electrocleaning . . . in conversion coatings for steel or aluminum . . . in any kind of pre-finish metal treatment. Write for bulletins discussing the operations you're interested in. Oakite Products, Inc., 59A Rector Street, New York 6, N. Y.

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over 50 Est. 1909 years' leadership in industrial cleaning

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61 . . . . for 61 years!

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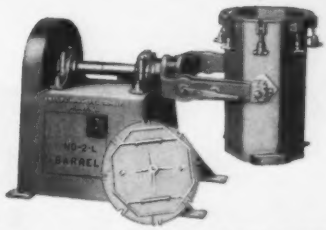
Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.



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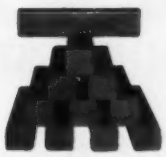
For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

RELIANCE KUL-KUT BUFFS FOR FAST CUTTING



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STANDARD SIZE 2 x 2 x 10"

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- **DURABILITY**
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THE PREMIUM BRIGHT NICKEL BATH

we admit it . . .
There may be other baths as bright as H-VW-M Superlume

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SUPERLUME

IS THE MOST DUCTILE AT HIGHEST LEVELLING

SUPERLUME

LEVELS BEST

H-VW-M

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Sure, it cost a little more than conventional bright baths — but no more than other baths that are almost as good as fast plating Superlume. Why not get the best! Write or call for full details.

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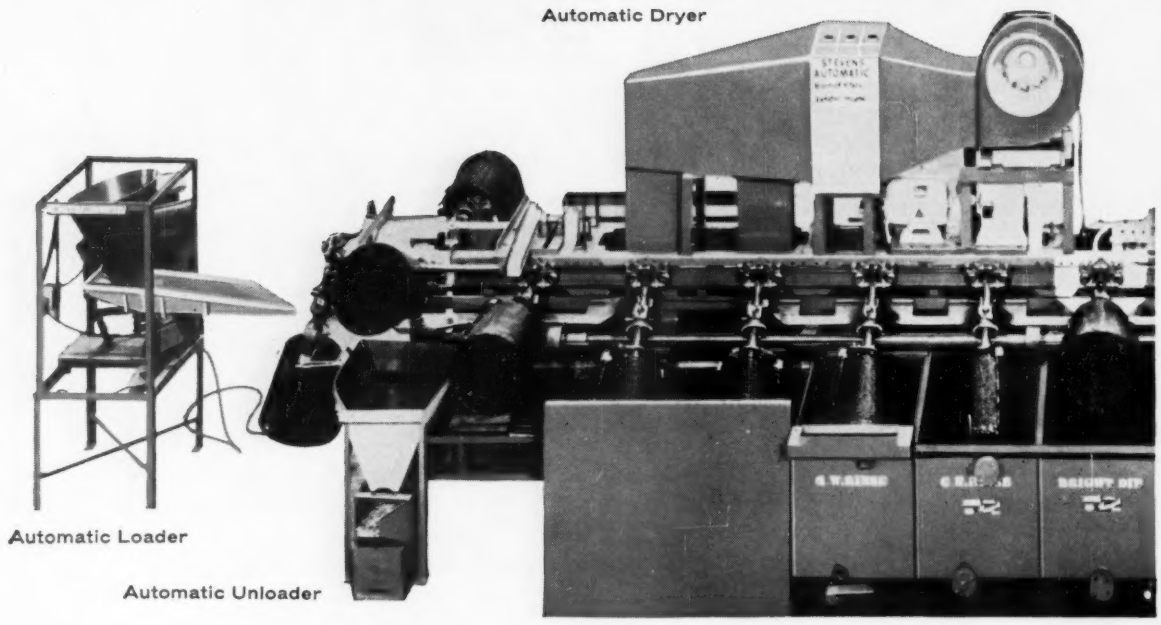
every 16 hours 2 million pounds of small parts are being plated or processed* in STEVENS AUTOMATIC BARREL MACHINES



*WASHING, BURNISHING, PHOSPHATING, BRIGHT DIPPING

It's a fact! Every working day a tremendous tonnage of small parts is being plated or processed in Stevens Automatic Barrel Machines. Why? Because Stevens builds the only barrel machine on the market today that provides complete automation.

AUTOMATIC LOADING...AUTOMATIC UNLOADING ...AND AUTOMATIC DRYING . . . are all within the machine. No extra equipment or floor space is required! When you think of truly automatic plating or processing, think of Stevens. Only Stevens can give you—

COMPLETE AUTOMATION • LOWEST COST PER PIECE
EXTRA SIMPLICITY OF OPERATION AND MAINTENANCE
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Write today for complete information on this processing profit-builder.

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Imperial's Plant Superintendent, left, and Wyandotte Representative Emil Haas examine frames cleaned with BUFSOL

MARIANO RANNO

"Bufsol removes hard, tenacious buffing compound"

— says Mariano Ranno, secretary-treasurer, Imperial Plating Co., Brooklyn, N.Y.

"Wyandotte BUFSOL has proved itself a real performer in our plant," states Mr. Ranno.

"We use it to remove a hard, tenacious buffing compound from polished-steel hand-bag frames — items we plate in large volume. These frames must meet exacting quality standards for jewelry-type nickel and brass plating.

"BUFSOL has reduced our over-all cleaning costs, thanks to its effectiveness under difficult conditions. And the Wyandotte representative has worked closely with us to help effect these savings."

* * *

All-soluble Wyandotte BUFSOL removes buffing compound *without solvents*. It's fast, safe, effective, and adaptable to every plating cycle.

BUFSOL liquid detergent concentrate assures bright, stain-free, adherent electrodeposits. And BUFSOL is safe on all metals, essentially odorless and will not contaminate your plating bath.

For full information and a demonstration of BUFSOL and other Wyandotte metal-cleaning products, call your Wyandotte representative today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California, and Atlanta, Georgia. Offices in principal cities.*

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THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

3,500,000 pounds of plating

processed by this UDYLITE TEMPRON cylinder . . . and it's *still going strong*

This TEMPRON Cylinder has handled more than three and one half million pounds of work without replacement or repair. This impressive performance was recorded at the Detroit plant of Bellevue Plating, a division of National Machine Products Co. There, 24 of these cylinders continue daily to deliver high economy, low maintenance production for the fifth straight year. They are operated regularly under extreme and abrupt temperature changes stubbornly resisting heat, cold, abrasion and chemical action.

In the experience of users everywhere, these rugged TEMPRON Cylinders, an original Udylite design, prove to be a best-possible buy. You, too, can achieve full production with an absolute minimum of shut-downs for maintenance by installing durable Udylite TEMPRON Cylinders in your plant. If you're not already enjoying the benefits of these perennially economic producers you owe it to yourself to investigate their money-making potential. Ask your Udylite man about TEMPRON cylinders or write . . .

Al Betteley of Bellevue Plating says:

"We are thoroughly satisfied with Udylite TEMPRON Cylinders. The only reason that we haven't bought more of them for our present equipment is that we haven't worn out the original ones. You may be sure that we will specify Udylite TEMPRON cylinders on any new equipment of this type."

the udylite corporation

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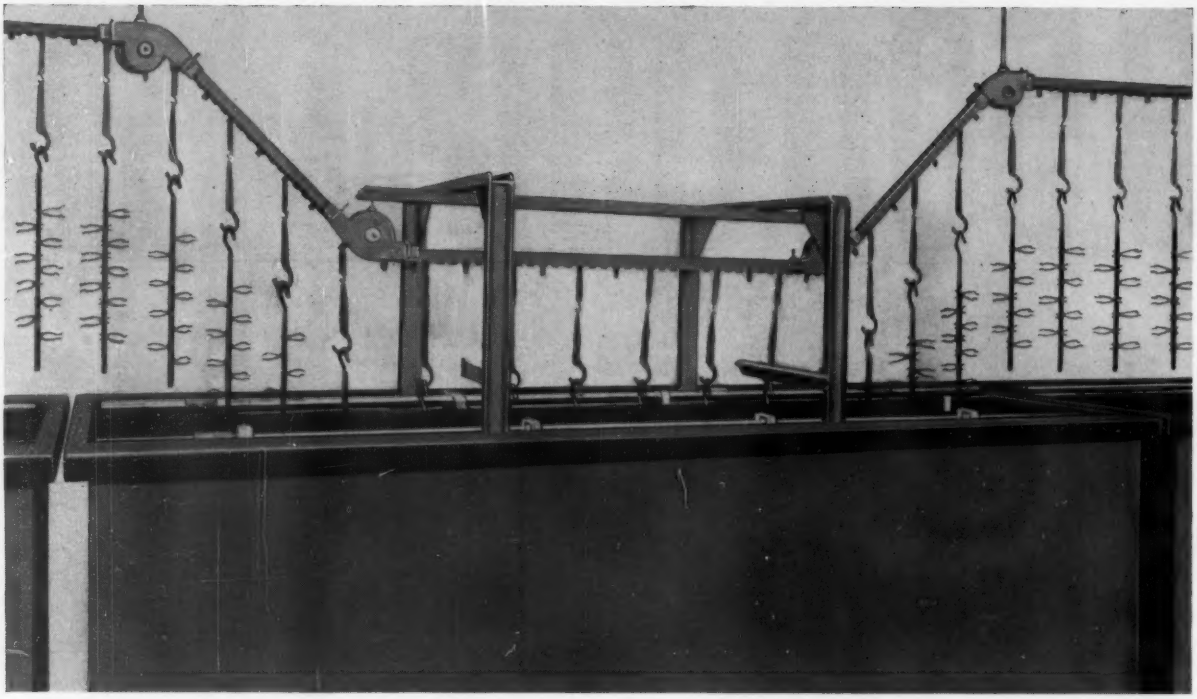
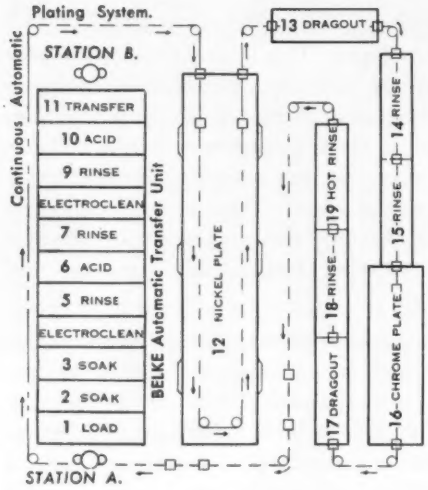


Chrome Plating Tank in a BELKE Continuous Automatic Plating System

Automatic Plating you **CAN** afford



Processing Cycle of above layout

STATION A. 1, Load racked work on BELKE Automatic Transfer Unit (used for quick transfer time to avoid oxidation and to process big production volume in small space with minimum labor). 2, Soak. 3, Soak. 4, Electroclean. 5, Rinse. 6, Acid. 7, Rinse. 8, Electroclean. 9, Rinse. 10, Acid —
STATION B. 11, Transfer racked work to Continuous Automatic Plating System. 12, Nickel Plate. 13, Nickel Dragout. 14, Rinse. 15, Rinse. 16, Chrome Plate. 17, Chrome Dragout. 18, Rinse. 19, Hot Rinse.
STATION A. 20, Unload finished work.

"Automatic Plating at one-third the cost quoted for conventional full automatics to do the same work!" . . . that's what users of BELKE Continuous Automatic Plating Systems report.

You can soon find out how much the BELKE Automatic System will save you and how much it will cost. Just tell us –

1. **Your complete cleaning, plating and after plating cycle – step by step – including the time in each bath.**
2. **The size, shape and number of pieces per rack.**
3. **The number of rack loads per day.**
4. **Send sketch, showing floor plan where equipment will need to be installed.**
5. **List of Power equipment, tanks, etc., you now have that you would like us to use in the BELKE Automatic System.**

When we get this information we will submit for your consideration a layout of suggested Automatic System with anticipated rate of production and approximate cost utilizing your present equipment wherever practical.

Belke MANUFACTURING COMPANY
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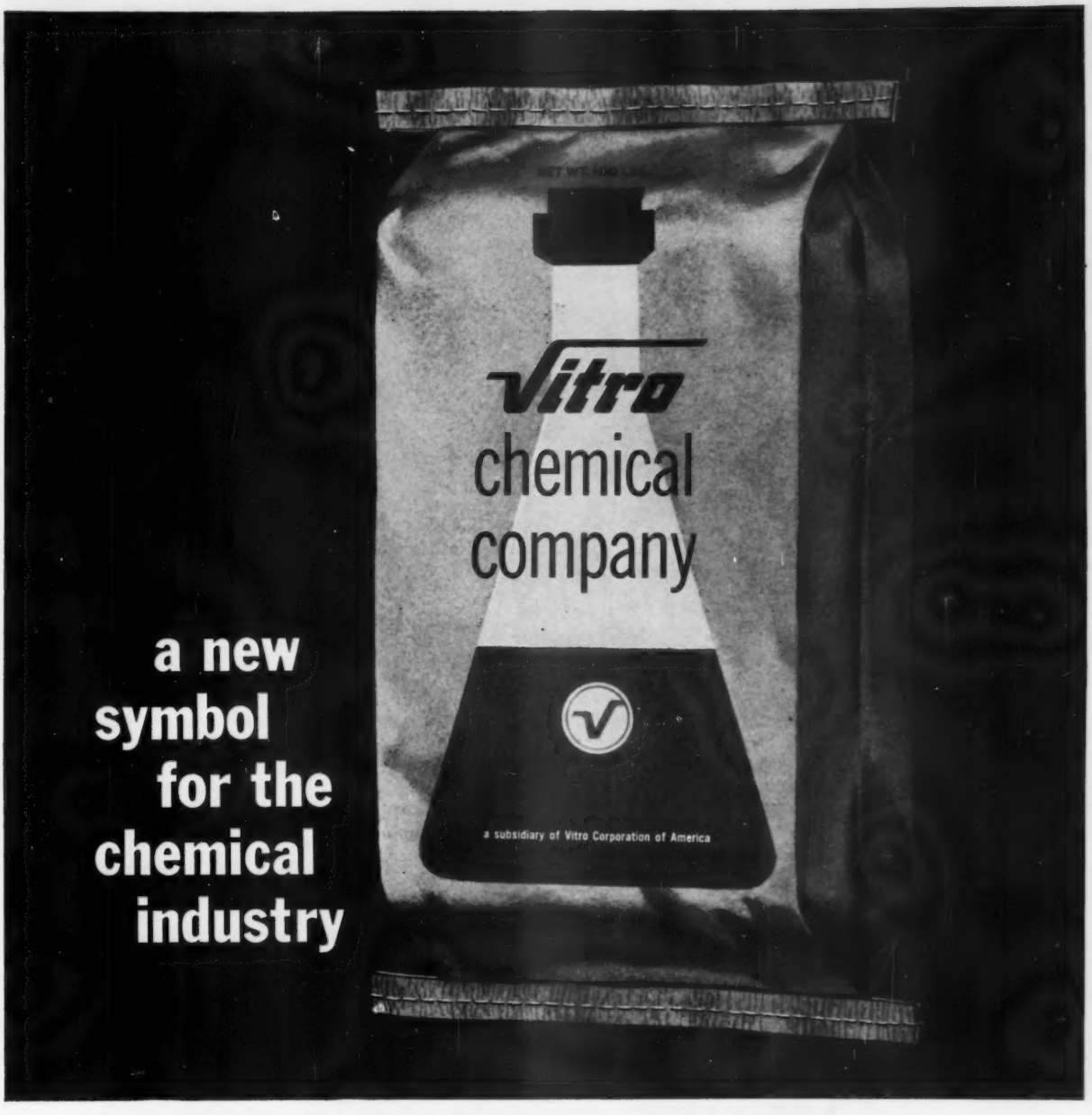
EVERYTHING FOR PLATING PLANTS



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Designed to match a process—not to meet a price!

Wagner Rectifiers are process engineered . . . designed to give uninterrupted power that correctly matches your particular process, thus assuring highest efficiency from both the equipment and process.

In addition to this basic process-engineered design, Wagner Rectifiers have important engineering features which make them far superior to anything on the market . . . yet they are priced competitive to comparable quality.

INSIST ON THESE 5 WAGNER FEATURES IN YOUR NEXT RECTIFIER:

1. **CUSTOM BUILT**—to do more than just meet your routine power needs . . . they're built to take the unexpected that occurs in every shop. Momentary extra heavy loads and short circuits are completely and harmlessly absorbed—without cell failure and without shortening rectifier life.
2. **MORE RECTIFICATION AREA**—twice the number of cells found in ordinary rectifiers, with each cell having over 2½ times the usual rectification area. This gives you a more uniform power supply . . . fewer operating troubles with maximum efficiency!
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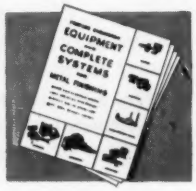
4. **OVERLOAD PROTECTION**—our exclusive built-in protective devices shut down the rectifier before highly unusual overload or other dangerous situation causes damage to the cells.
5. **RUGGED COMPONENTS**—Wagner-built transformers have Class B insulation (inorganic materials) . . . exposed bus bars are silver plated . . . housings are ruggedly built . . . meters are shielded to protect their precision accuracy.

Wagner Silicon Rectifiers are available in capacities ranging from 300 to 50,000 amperes with full selection of controls for manual or automatic regulation. Wagner Selenium Rectifiers also available in the same range of capacities.

Ask your Allied Field Engineer about the many advanced features of Wagner Rectifiers and how they can benefit you in your operations. You'll find his name listed under "Plating Supplies" in the yellow pages. Or, write for FREE TECHNICAL DATA FILES.



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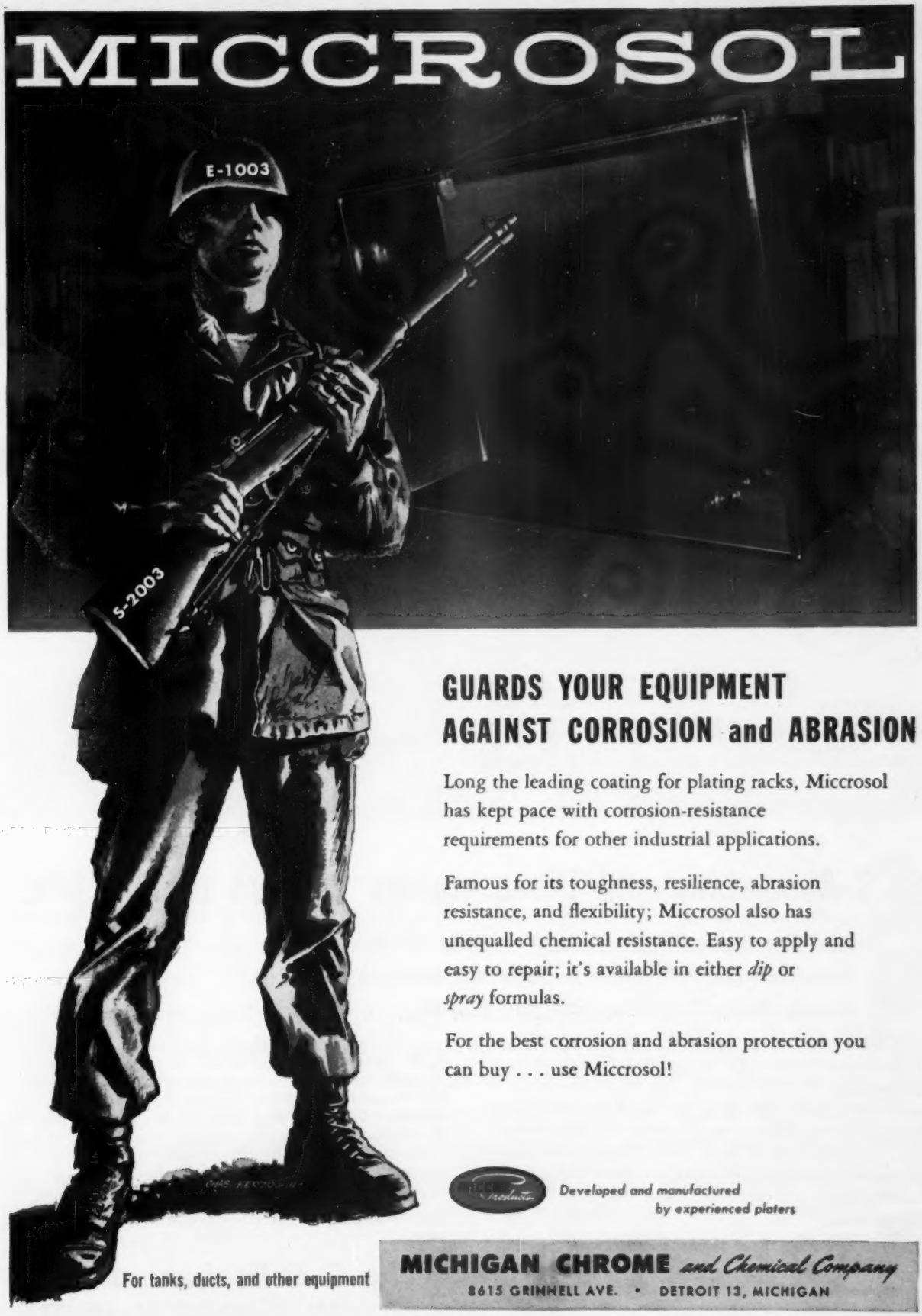
IRIDITE® Chromate Coatings | IRILAC™ Clear Coatings | ISOBRITE® Plating Brighteners | ARP® Chemicals & Supplies | WAGNER Line of Equipment

MICCROSOL



GUARDS YOUR EQUIPMENT AGAINST CORROSION and ABRASION

Long the leading coating for plating racks, Miccrosol has kept pace with corrosion-resistance requirements for other industrial applications.

Famous for its toughness, resilience, abrasion resistance, and flexibility; Miccrosol also has unequalled chemical resistance. Easy to apply and easy to repair; it's available in either *dip* or *spray* formulas.

For the best corrosion and abrasion protection you can buy . . . use Miccrosol!

Developed and manufactured by experienced platers

For tanks, ducts, and other equipment

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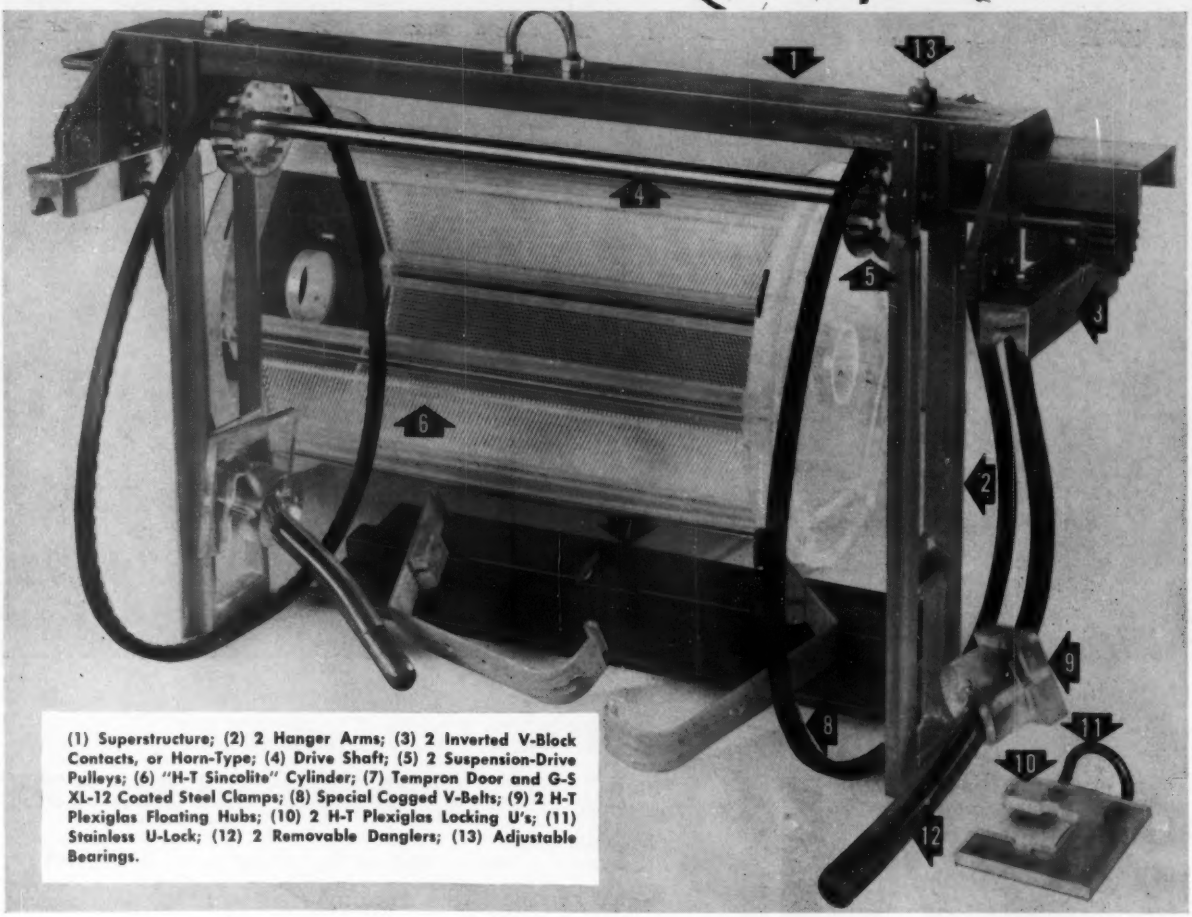
LOOK, NO TOOLS!



(1) Superstructure; (2) 2 Hanger Arms; (3) 2 Inverted V-Block Contacts, or Horn-Type; (4) Drive Shaft; (5) 2 Suspension-Drive Pulleys; (6) "H-T Sincolite" Cylinder; (7) Tempron Door and G-S XL-12 Coated Steel Clamps; (8) Special Cogged V-Belts; (9) 2 H-T Plexiglas Floating Hubs; (10) 2 H-T Plexiglas Locking U's; (11) Stainless U-Lock; (12) 2 Removable Danglers; (13) Adjustable Bearings.

G-S Assembles and Disassembles in Less than 5 Min.

Remove Danglers for Maintenance: 10 Seconds!
Interchange Cylinders: 5 Minutes; Save Hours!
Quick, Easy One-Man Job; No Tools!

Platers report up to 70% savings in maintenance man-hours alone — not to mention proportionate savings in production down-time, etc. More good reasons why all plating barrel makers are following G-S basic design. You get a $2 "bonus" with every $5 profit from your operations by using G-S barrel equipment. All due to better, faster plating; less downtime, lower maintenance costs.

Only G-S Offers You These Time-Proven, Patent-Protected Features:

Temperatures to 220°F. Solutions others can't tolerate.
Loads to 275 lbs. Bigger pay loads. Safer.
All-Bolted or All-Welded Cylinders. Heavy-ribbed, longer life.
Bussed for More Amps. Better, faster plating.
G-S "Cogged-V-Belt" Drive. No gears in solution.
Inverted V-Contacts or Horn-Type. Fit your equipment.
Floating End Plates. Constant contacts, no arcing.
Adjustable Bearings. Constant mesh with drive gears.
Floating Hubs with Locking-U. Direct danglers down.
Heavier Dangler Cables. Higher currents. And many more.

Send for details, prices on complete G-S line of plating equipment. Manufactured by The Singleton Co.

The G-S Equipment Co.

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THE NEW

BRIGHT NICKEL PROCESS

LEVELMAX

for excellent brightness, levelling, and ductility at low cost

Now—for the widening use of nickel plating and the new plating problems brought about by the wider variety of shapes and base metals—ASARCO has developed a new process, simple to control and maintain. LEVELMAX will tolerate considerable organic and metallic contamination even with infrequent purification or treatment. Buffing and finishing of the base metal can often be completely eliminated. Hard-to-buff areas can be plated bright. The bright-nickel surface readily accepts chrome. Corrosion resistance is excellent. Maximum productivity is assured by high current densities which are successfully used with the LEVELMAX process. Conventional or air agitation can be used. Analytical procedures are provided for the determination of all constituents. Write for complete working details about the new LEVELMAX BRIGHT NICKEL PROCESS to Federated Metals Division of American Smelting and Refining Company, Electrochemicals Dept., 120 Broadway, New York 5, N. Y. In Canada, Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION

ASARCO

Planned Quality

And How Summit Finishing contributes to its achievement with

AHCOLOID CLEANERS

Precision finishing of close tolerance parts and metal strip requires the high degree of engineering experience and ability for which The Summit Finishing Company of Thomaston, Conn. is known throughout the plating industry, and which dictates their selection of Ahcoloid Cleaners #200 and #202A. Naturally, only top quality materials could adequately complement engineers and facilities ranked among the best in the business to produce a superlative output. Top quality is always *planned* quality and the experienced engineering planning necessary to select the compound best integrated with your cleaning procedures is yours from Hubbard-Hall on request.

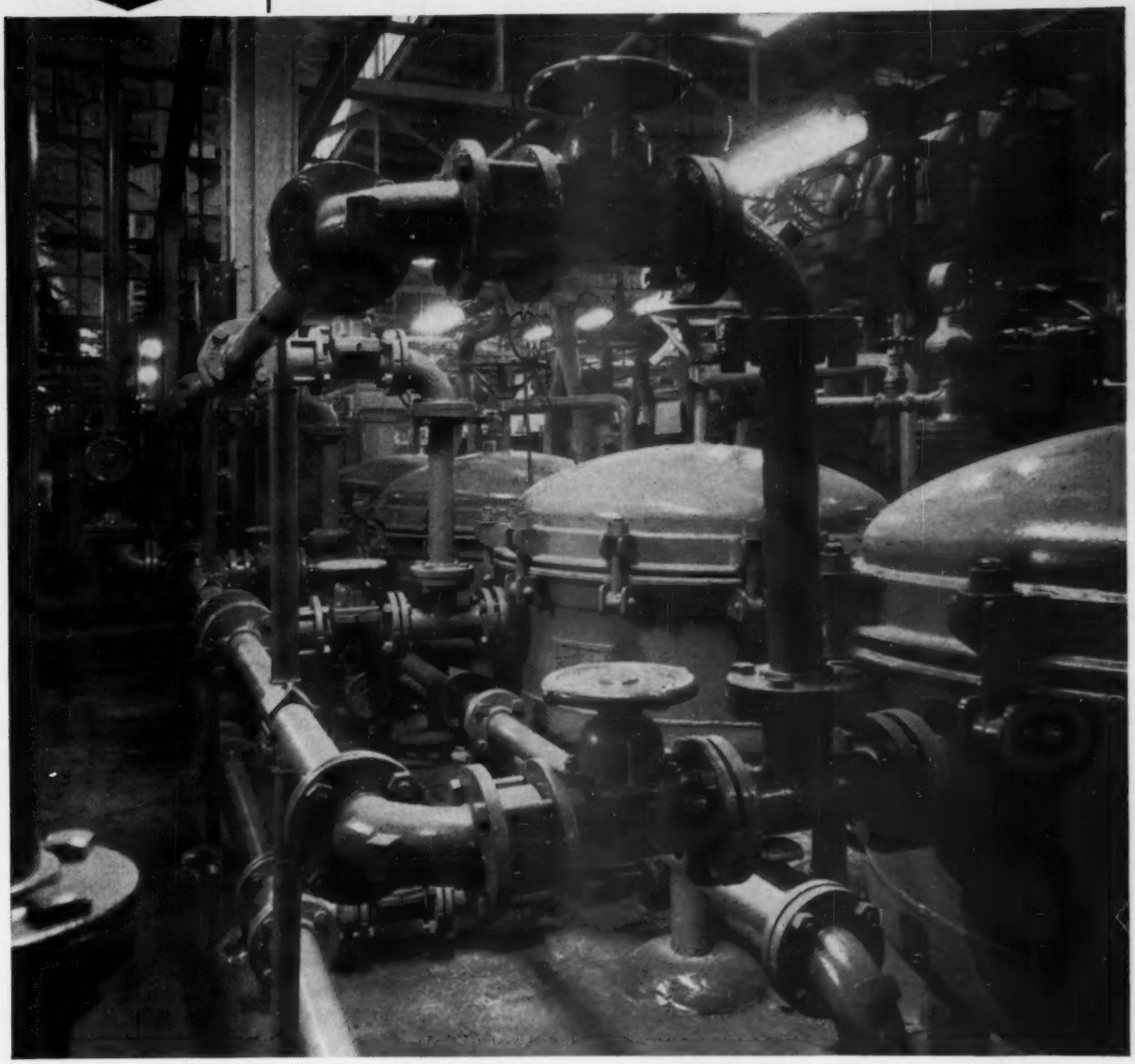
Hubbard Hall

THE CHEMICAL CO.

WATERBURY 20, CONN.

Apothecaries Hall Division

DOW | SARAN LINED PIPE



After 80,000,000 gallons of hot acid . . .

not a failure in 5,000 feet of Saran Lined Pipe

7,500 gallons per hour of hot acid solution . . . nearly two years of continuous trouble-free service with little maintenance . . . and there's never been a failure or replacement in the 5,000 feet of Saran Lined Pipe.

The above installation is a portion of the exclusively used Saran Lined Pipe which serves the plating plant of a leading automotive hardware manufacturer. This piping carries highly reactive copper and nickel plating solutions to plating machines, then returns them for filtering before reuse. Solution temperatures range from 105° F. to 150° F. Saran Lined Pipe is also used to connect plating tanks to heat exchangers, and as supply and return lines to solution storage tanks.

Plant engineering personnel state that the advantages they find in Saran Lined Pipe are ". . . corrosion resistance to the chemicals, ability to withstand temperatures of 150° F., strong and rigid enough to be installed without need of additional support."

When plans call for piping systems that must resist corrosion and chemical activity, specify Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, and from below zero to 200° F. They can be cut, fitted and modified easily — right on the job. For more information write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 2501CF3.

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Quality is a Built-in Component. That's why CATERPILLAR TRACTOR CO. has used PREP PRODUCTS continually for 22 years.

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You too will get better results with this supreme line!

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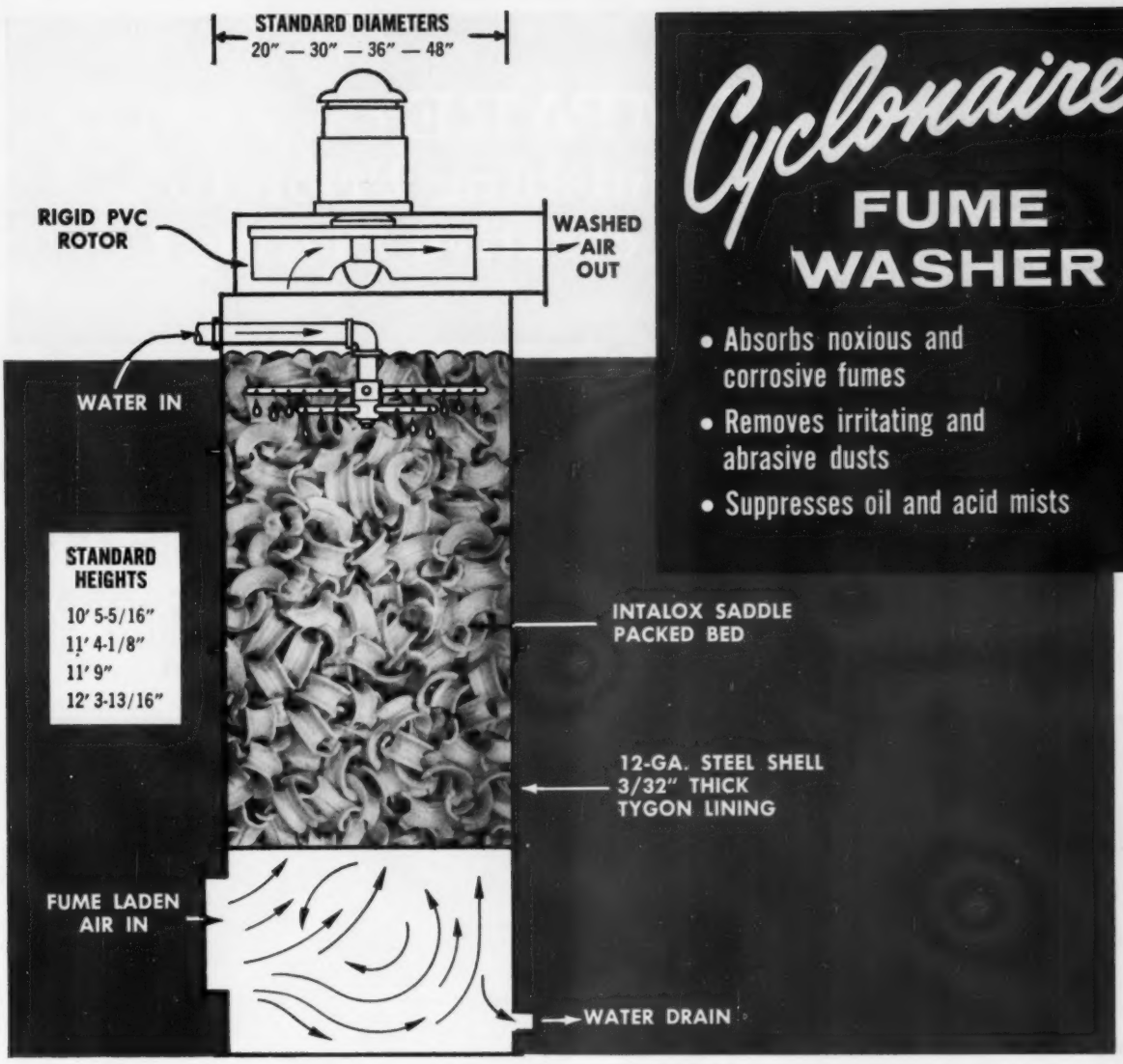

Cyclonaire FUME WASHER

- Absorbs noxious and corrosive fumes
- Removes irritating and abrasive dusts
- Suppresses oil and acid mists

The "Cyclonaire" is a surprisingly compact wet bed scrubber. It will fit almost anywhere, but it does a fume removal job formerly possible only with expensive custom-designed units. Removal of many gases (of 1% concentration or less) is up to 99% effective. Low power requirements make it very economical to operate.

The standard "Cyclonaire" consists of a bottom section containing a packing support plate, fume intake duct, and liquid drain; two intermediate sections packed with Intalox Saddle Packing; a distributor section containing a water or liquid inlet and liquid distributor; and a top section containing the blower, drive motor and washed air outlet.

The unit is made of 12 gauge steel, lined with 3/32" thick Tygon sheet plastic. The rotor is made of rigid PVC plastic. All exterior surfaces are protected with Tygon "ATD" Hot Spray Paint.

The "Cyclonaire" is available in four sizes with rated capacities of 750, 1650, 3500 and 6000 cfm.

Its low initial cost, its low operating cost, its high efficiency make the "Cyclonaire" a logical choice for a wide range of fume scrubbing operations. Full technical data in Bulletin FW-10. Write for it today.

PROCESS EQUIPMENT DIVISION

U. S. STONEWARE

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376F

COMPARE Grav-i-Flo's Finishing Prior To Decorative Plating!

Grav-i-Flo Has Exclusive Materials To Produce Finishes Heretofore Impossible In The Tumbling Field—And On Nearly Every Shape And Size Part By These Two Processes:

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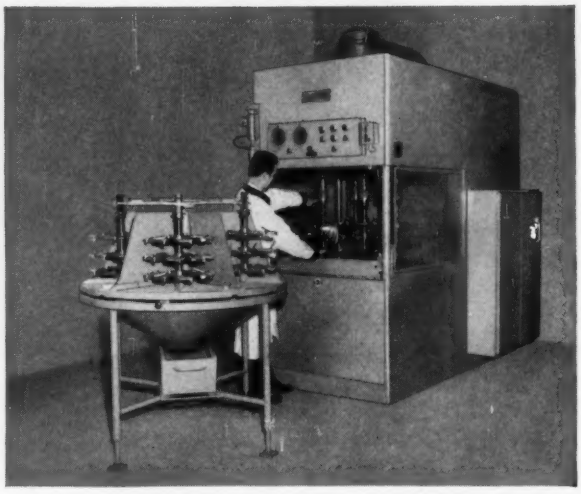
Grav-i-Flo exclusive barrel finishing materials make it possible to obtain finishes in a tumbling barrel that no other process can produce. Grav-i-Flo chips are the most outstanding of all barrel finishing medias on the market for decorative finishing. Many customers ultilize Grav-i-Flo's plant facilities for job tumbling of parts on which they have been unable to obtain satisfactory finishes—and then later install their own facilities.

SPIN-FINISH



Large parts, intricate shape parts not suited to tumbling and previously finished only by buffing, are now finished in production quantities to high lustre surfaces with Grav-i-Flo's Spin-Finish machines. This short, automatically timed operation offers tremendous savings in schedules, labor and floor space. No set-up time required for changing jobs. This is a completely dry process, dust and fume free, eliminating ventilating systems.

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for better finishes prior to decorative plating. Grav-i-Flo personnel were the pioneers—and are still the leaders in tumble finishing.

GRAV-I-FLO CORPORATION

Sturgis, Michigan

DEPT. MF 3

Sunbeam applies the finishing touch with

MUTUAL CHROMIC ACID

Sunbeam tops off good construction and design with smart, sturdy chrome plate to win consumer favor for its sparkling line of appliances. Mutual® Chromic Acid and Sunbeam plating technique team up for a brilliant finish.

Mutual Chromic Acid is always 99.75% pure – or better. Its low sulfate content (less than 0.1%) makes it easier for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

To learn more about these and other advantages of Mutual Chromic Acid, send coupon for our free booklet, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions.

OTHER PRODUCTS FOR PLATERS

SOLVAY® Ammonium Bicarbonate • SOLVAY Caustic Soda
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MUTUAL chromium chemicals are available through dealers and SOLVAY branch offices located in major centers from coast to coast.

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☐ Send Bulletin 52, "Chromium Chemicals"

☐ Have a representative phone for appointment

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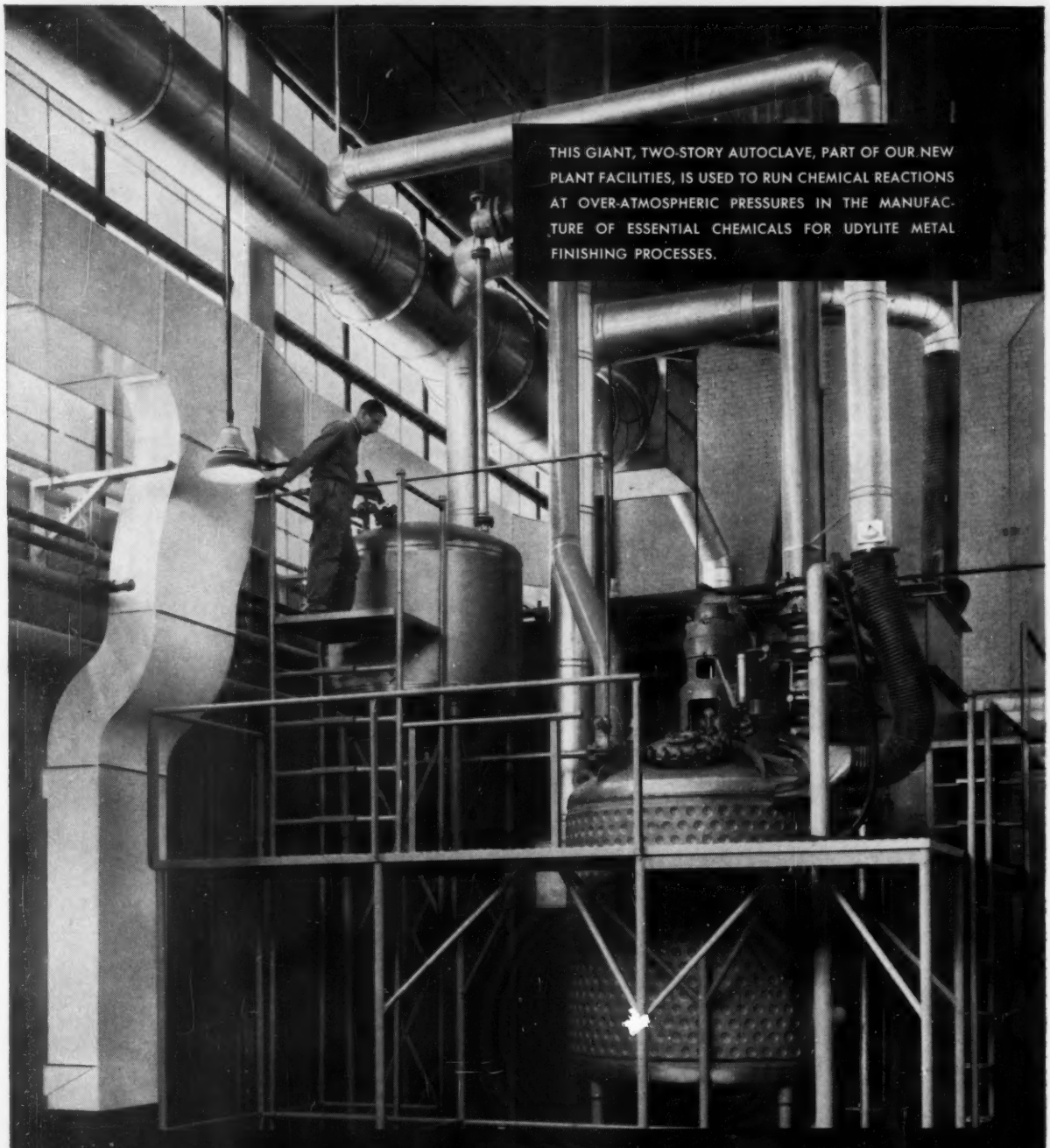


THIS GIANT, TWO-STORY AUTOCLAVE, PART OF OUR NEW PLANT FACILITIES, IS USED TO RUN CHEMICAL REACTIONS AT OVER-ATMOSPHERIC PRESSURES IN THE MANUFACTURE OF ESSENTIAL CHEMICALS FOR UDYLITE METAL FINISHING PROCESSES.

$600,000.00
Invested in your future:

It cost that much to complete additional new plant facilities at Udylite in order to guarantee you: *1*—absolute purity of product, 2—stringent quality controls, 3—reasonable price schedules. Now you can *depend* on these benefits from Udylite for years ahead, as our industry expands.

the udylite corporation
Detroit 11, Michigan

on the west coast:
the L. H. Butcher Company

Forward March in 1960...

Udylite offers new products, processes

MAJOR DEVELOPMENTS IN EVERY PHASE OF THE INDUSTRY COME FROM THE WORLD'S LARGEST PLATING SUPPLIER

Udylite steps up the production of new equipment and processes and continues its expanding program of research and new product development. Here are some of the New benefit-packed innovations that Udylite has ready for you NOW.

New Barrel assembly Just released, Udylok-Tempron Barrel Assembly . . . unique interlocking cylinder construction which permits speedy field repair . . . tie-rod-free construction . . . twelve machine screws the only metal used in cylinder . . . advanced ring gear design with heavy duty, four pitch gearing for greater strength . . . longer life . . . made of non-corrosive Udylon . . . *and* a revolutionary new superstructure design.

New Rectifier line A whole new line . . . completely re-designed from the ground up . . . economies affected with new method of manufacture mean real savings in your original cost . . . keep maintenance and replacement costs minimum . . . fully guaranteed and built to usual high standards of Udylite quality construction.

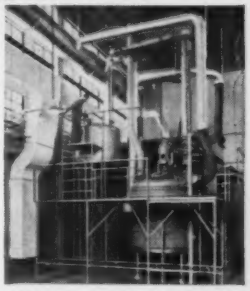
New Tank lining Brand new tank lining . . . for special applications . . . introducing a new recently perfected material of unusual properties . . . an EXCLUSIVE with Udylite.

New Filter series Improved . . . high area . . . low pressure filters . . . designed with economy of operation in mind for you . . . long range savings . . . low, low maintenance costs . . . greatly increased efficiency . . . full range of sizes and capacities.

New Processes due Another great forward step in the battle against corrosion . . . A NEW Udylite bright plate process . . . now under rigorous testing for introduction early in the spring . . . a product of the continuing research and development that gave you "The Incomparable 66" and Bi/NICKEL.

New Automatic Machine features Plating automation . . . equipment advances . . . including new skip mechanism . . . 1960 models of Cyclemaster . . . and the famous Udylite V.I.P., automated barrel plating machine . . . to fit economy budgets.

New manufacturing facilities $600,000.00 expansion program at Udylite, Detroit . . . installation permits quality controlled production of vital raw materials . . . guarantees source of supply . . . provides you with product of insured purity . . . at a reasonable price.



Giant autoclave . . . new plant facility at Udylite

The newest and the best in plating supplies, equipment and processes . . . products such as those shown here flow constantly from Udylite to industry. Watch for detailed announcements every month. If you'd like to learn more about any of the developments we've talked about right away, just get in touch with your Udylite man today or write to:

the udylite corporation • Detroit 11, Michigan
world's largest plating supplier

on the west coast the:
L. H. Butcher Company

Here is a sampling of CLEPO soak cleaners available for general purpose use and specific application.

WHAT'S NEW IN SOAK CLEANERS?

For removing oils and other lubricants from steel. Excellent emulsifying properties.	CLEPO 26-E
For cleaning oil and shop dirt from steel; copper, brass. General utility cleaner.	CLEPO 36-K
For removing buffing compounds, oil, shop dirt and sulfurized oil from all metals. Can be used cold.	CLEPO 135-H
For removing oil, lettering, sulfurized oil and buffing compounds from aluminum and zinc without attack.	CLEPO 86-P
For removing buffing compounds from all metals.	CLEPO 90-J
For removal of drawing compounds from aluminum and heavy oils from all metals prior to alkaline cleaning. Can be used cold.	CLEPO 8-S
For cutting sulfurized oil, grease, buffing compounds for removal in a subsequent soak cleaning operation. Solvent cleaner. Contains no chlorinated compounds.	CLEPO COLD DIP B

Soak cleaners are among the most widely used types of cleaners and every day new ones are being developed to meet the requirements of new applications. How to remove a special oil, other lubricants, a newly developed buffing compound or similar soils most effectively and economically are problems which your CLEPO technical representative and the Frederick Gumm laboratory staff have been solving for many years.

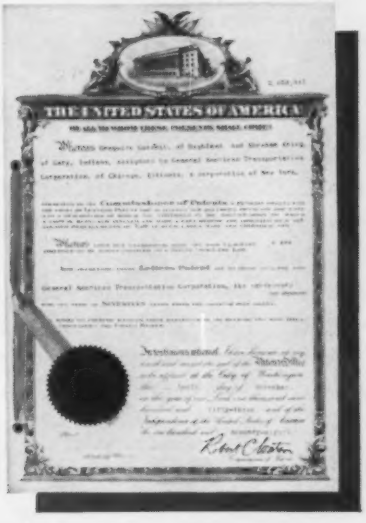
The results: a broad line of both general purpose and specific soak cleaners for your selection plus the ability and experience to design effective new cleaners when required, at a minimum of time and cost to you.

Send for Technical Bulletin 360

FREDERICK GUMM CHEMICAL COMPANY INC.
538 Forest Street, Kearny, N. J.

a Reminder

to those who use chemical nickel alloy plating:



There is only ONE

Kanigen®

and 29 patents prove it

There are no substitutes for Kanigen—no other process that applies a hard, corrosion-resistant nickel alloy coating without the use of electricity as Kanigen does.

With Kanigen, you can plate anything from a small relief valve to a 20,000 gallon tank car with a virtually non-porous, uniform coating.

How can you be sure of getting Kanigen? Only one way—by calling General American or one of its licensees. For further information write:

Kanigen Division

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Chicago 3, Illinois
Offices in principal cities

LICENSEES

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Coming next month!

COVERS DETAILS OF EVERY COMMERCIAL PROCESS

METALLIZING OF PLASTICS

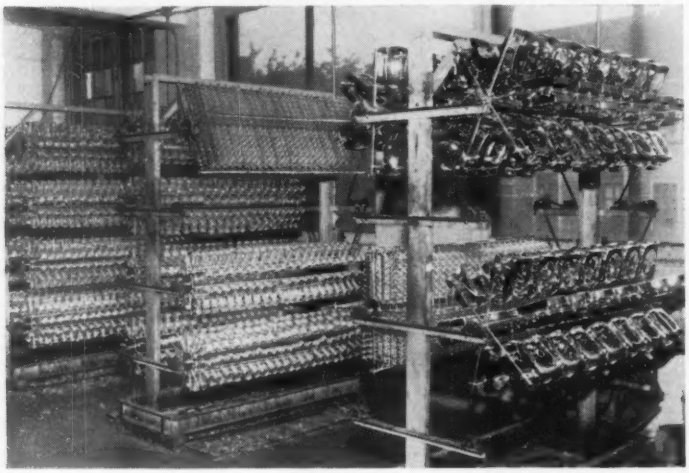
by HAROLD NARCUS

President and Technical Director, Electrochemical Industries, Inc.

1960, approximately 224 pages, 55 illustrations, $5.50

THIS EAGERLY AWAITED BOOK presents complete details for carrying out every commercial metallizing process for plastics or other nonconductors. It is the first treatment of the subject that deals with *actual production procedures, formulations* and *techniques* for all known metallizing methods. These include the copper film process (developed by the author), the deposition of "electroless" nickel coatings, a review of the new molded conductive plastics, "gas" plating, the deposition of thick evaporated films and many, many others. The text is replete with illustrations showing the latest equipment being used in the newer processes. Recent advances receive special attention, particularly in the final chapter. This chapter contains developments as recent as a few months ago.

Much more than a bibliographic source, this book is essentially a metallizing manual for the plastics, electronics and electroplating industries.



CONTENTS

Deposition of Metallic Coatings by Chemical Reduction
Vacuum Metallizing
Cathode Sputtering Process
Silver Spray Method
Miscellaneous Metallizing Methods
Characteristics and Testing of Metallized Deposits
Future Potential Uses for Metallized Plastics and Other Nonconductors
Bibliography
Index

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CORROSION RESISTANT

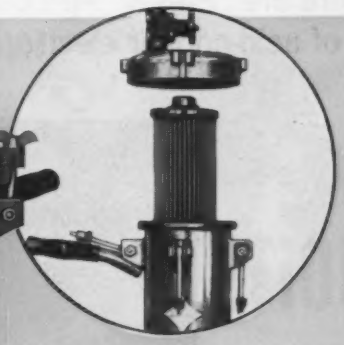
Note these features:

Chamber and Cover: Steel, vulcanized rubber lining.

Filter Element: Non-woven resin impregnated fabric, molded into epoxy-phenolic ends.

Hose: Three ply, durable, acid resistant. Plastic or Hastelloy fittings.

Pump: Vulcanized, rubber-lined steel chamber. Carpenter 20 Shaft, proven mechanical seal; carbon and ceramic components.



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Flip-top cover lifts off. Pull-out cartridge can be replaced or rinsed and reused in seconds.

100% PORTABLE
Mounted on two 6" dia. wheels. Full swivel rear coaster insures complete ease of movement.

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Now you can eliminate the time and expense of bothersome repiping and the need and equipment for separate plating solution filtering stations.

The new type 118 *heavy duty* Industrial filters are rugged, but compact; low in cost but typically *Industrial*-engineered and rubber-lined throughout for corrosion resistance. The heavy duty *Industrial* pump is of the same long proven design employed in hundreds of *Industrial* filters now in plating service.

Look at the features . . . look at the specs . . . look at the *work* capacity. You can get this complete, proven-dependable filtration system in but six *portable* square feet of work area.

WRITE FOR BULLETIN 118.

TWO MODELS AVAILABLE
Single tube 600 gph capacity, is convertible to double tube 1200 gph capacity model shown above.

CHECK THE SPECS:

- 600 and 1200 gph capacity
- 15 and 30 sq. ft. filtration area
- Temperatures to 170° F.
- Unit 50 P.S.I.G. operating pressure
- Fully proven in plating use

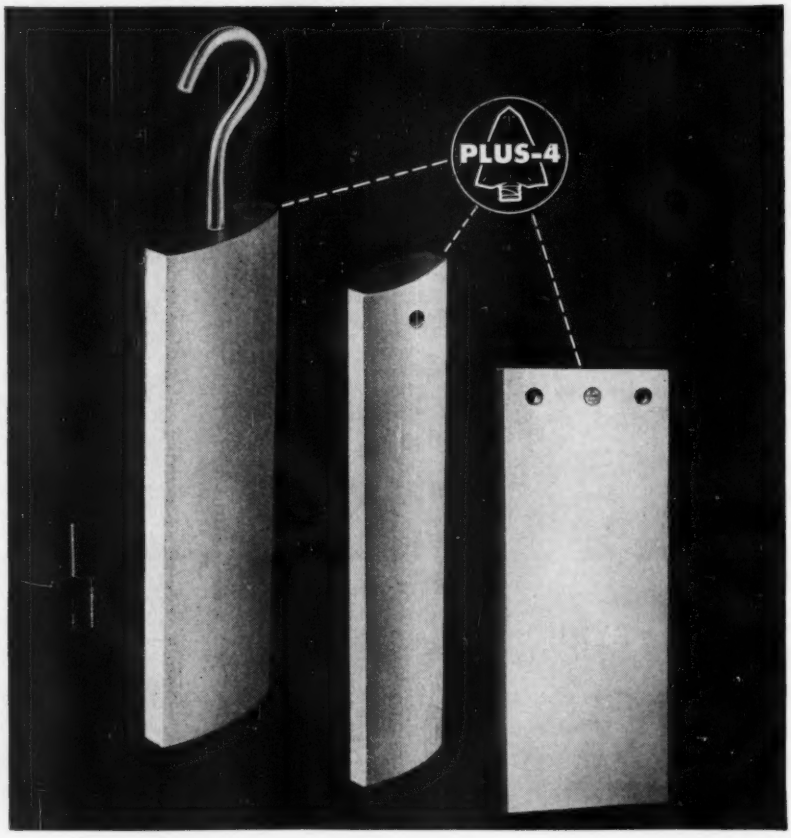
INDUSTRIAL FILTER & PUMP MFG. CO.
5906 Ogden Avenue, Cicero 50, Illinois

INDUSTRIAL

P-859

WHATEVER FORM OR SIZE YOU NEED

there are "Plus-4"® (Phosphorized Copper) Anodes to help you cut the costs of acid-copper electroplating—at the same price as ETP copper anodes



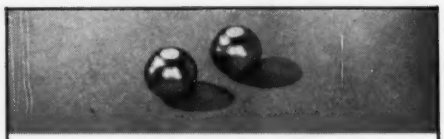
"Plus-4" Anodes in commercial use in practically all types of acid-copper electroplating have proved their advantages over wrought or cast electrolytic tough pitch copper anodes. The four advantages indicated by the name are:

+ 1 No anode sludge (no "bagging" or diaphragms required).
+ 2 No copper build-up in the solution.
+ 3 Smooth, heavy cathode deposits.
+ 4 Up to 15% more cathode deposit.

THE REASON for the elimination of sludge formation is that an anode of phosphorized copper develops an adherent dark brown film during electrolysis, which prevents the formation of free copper particles, but which in no way interferes with the plating operation or increases the electrical resistance of the bath. The phosphorized copper anode also corrodes more evenly, depositing more copper per pound on the cathode; gives a smooth, heavy deposit free from roughness due to lodgment of copper sludge particles; and leaves a small, compact "fish." There is no copper sludge or build-up of copper sulfate in the electrolyte.

WRITE FOR INFORMATION on how you can obtain a test quantity to supply one tank. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Toronto 14, Ontario.

59107



FORGED BALL ANODES

Anaconda ETP Copper Ball Anodes, used widely in cyanide plating, are cold forged from wrought metal. The result is a homogeneous, fine-grain structure, free from voids. Consequently they corrode very uniformly without disintegration. The balls are 2" diameter and weigh 1¼ pounds each. Identify them by the spearhead trademark.

ANACONDA®
"PLUS-4" ANODES
Phosphorized Copper
Made by The American Brass Company

All HARSHAW Nickel and Copper Plating Processes Operate Successfully with Either

CATHODE MOVEMENT or AIR AGITATION!

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Harshaw Perflow Semi-Bright Nickel
Harshaw Perflow-Perglow Duplex Nickel
Harshaw Cynorex Cyanide Bright Copper
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All Harshaw processes have been highly successful in their operation with mechanical agitation. Where particular conditions have dictated the need for Air Agitation, Harshaw processes are operated very effectively with beneficial results. If your requirements indicate that Air Agitation will benefit you, Harshaw is prepared to offer a suitable process.

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#501

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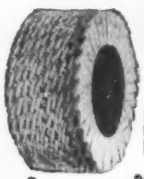
performs every job a bias-type buff can do . . . . . and more too!

#501
A STANDARD BUFF

The Churchill #501 is a standard buff that has **proven** its worth for buffing all standard jobs without excessive wear on any part of the face. This general purpose Finger-Buff* #501, with the 6" wide buff finger (each overlapped by the two adjacent fingers) has **proven** to run at cooler temperatures, to wear down uniformly, to give a better cut and to last longer!

For low cost, cut-color operations it will pay you dividends to investigate this super-flexible Churchill Buff #501 . . . for all standard jobs **PLUS** those special jobs that give bias-type buffs trouble.

• *Churchill Finger-Buffs* are competitively priced. Produced in all sizes from 3" to 21" diameters. For complete information write your problem.*



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The Original **FINGER BUFFS***
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for Zinc and Cadmium

KER-CHRO-MITE P produces LUSTROUS YELLOW or CHROM-CLEAR finish for ZINC or CADMIUM. Supplied as powder. Needs only few ounces per gal.

KER-CHRO-MITE #4 produces mirror-bright finish on ZINC & CADMIUM. Ideal for fully automachines or manual vats. Costs about 1 to 2 tenths of a cent per sq. ft.

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ZIN-K-LUX FC a newly improved ZINC sol. brightener and purifier. Produces lustrous finish right out of the tank. Compatible with almost all addition agents.

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BLACKENING SALTS for CADMIUM or ZINC. Produces jet black finish.

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New machine for dipping processes...

Crown "M-P" Multi-Purpose automatic processing conveyor

Crown M-P (Multi Purpose) Conveyors are a new development in basic design and control that brings automatic dipping processing to all industry for multi cycle processing in plating—anodizing—painting—phosphatizing and rubber dipping operations. Using the basic "M-P" concept, machines can be built to meet your specific requirements by incorporating one or several of these important Crown features:

- **Each carrier can be set for one of several different cycles.**
- **One machine that can plate two or three different metals.**
- **Horizontal and oblique barrels and even racks can operate on the same machine.**
- **Rack and barrel work can be plated at two different voltages on one machine.**
- **Work can be plated at four different thicknesses at the same time.**
- **Size of parts can vary from ¼ inch to 40 feet in length.**
- **Weight per station from ten to three thousand pounds.**
- **Lifts from 12 inches to 12 feet.**
- **Rotation, tilting, or other auxiliary motion during transfer.**
- **Machines of this type have been at work in actual production for over 2 years.**

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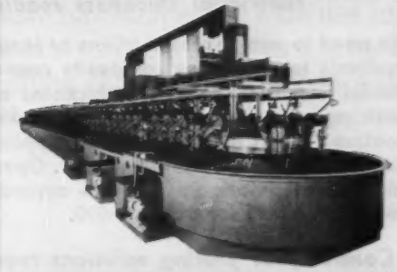

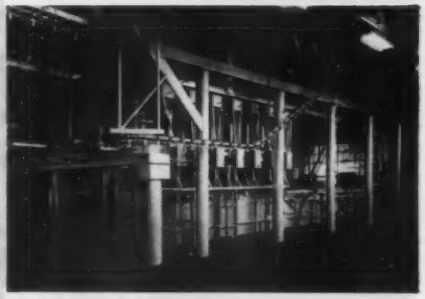

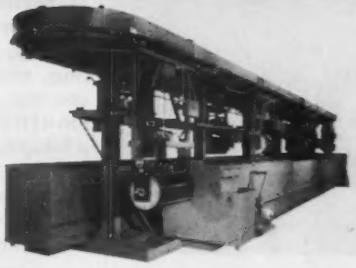

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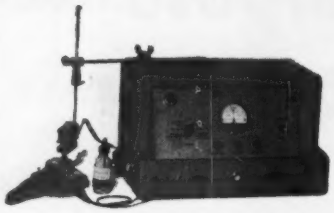

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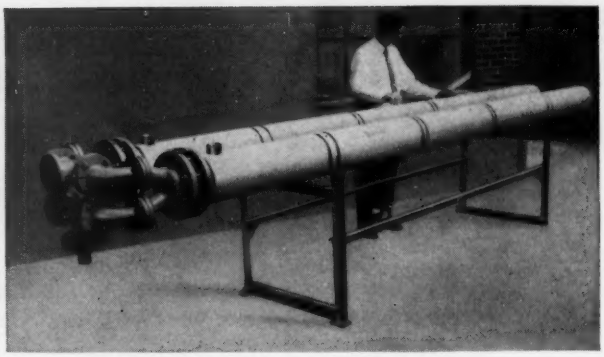

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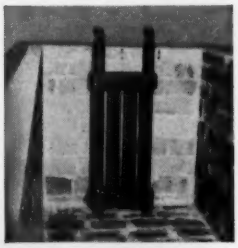

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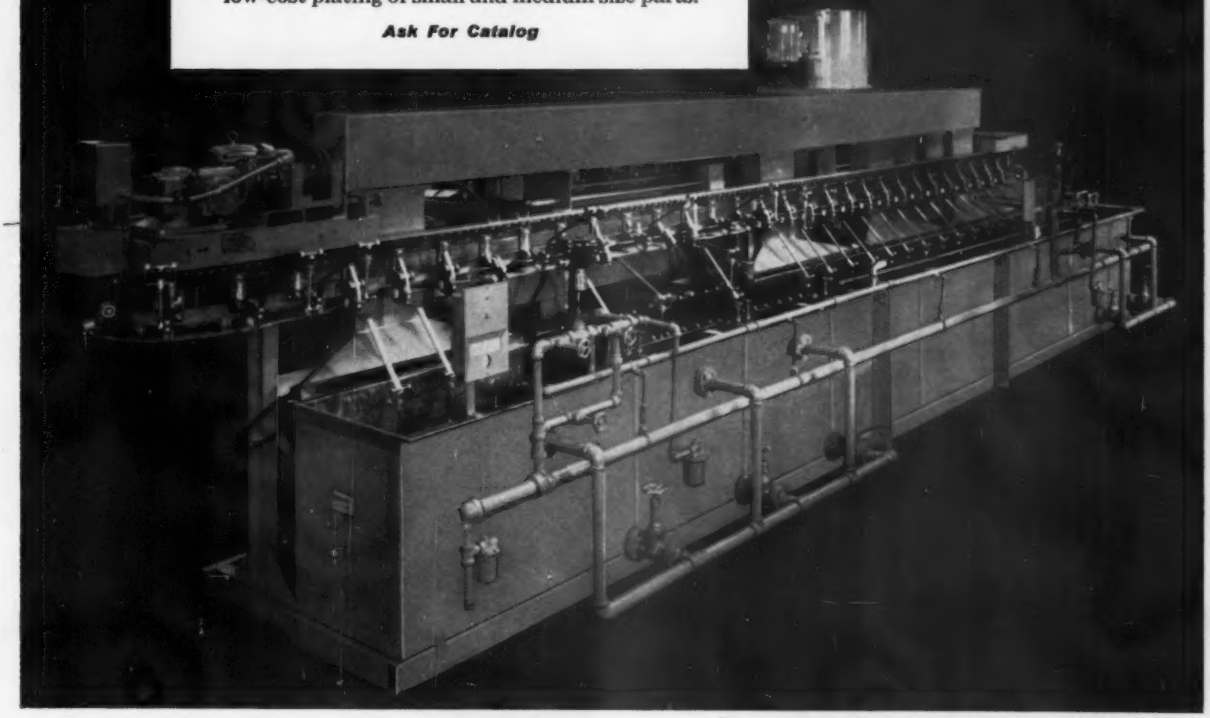

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With a special chapter by GEORGE B. McCOMB
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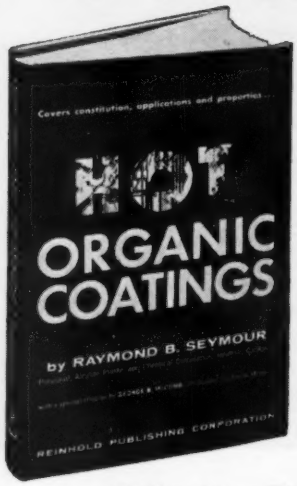
1959, 244 pages, $7.50

The constitution, applications and properties of hot organic protective coatings are concisely presented here. The book contains chapters on widely used hot organic materials such as asphalt, coal-tar pitch, petroleum waxes and cellulose derivatives. Specific information on formulations of proprietary products is included. Additional chapters deal with hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process. One chapter on hot applied coal tar pitch base coatings is supplied by George B. McComb, consultant to the leading suppliers of pipe line coatings. Hot spray techniques and the many advantages of this application are also covered. This book will be helpful to everyone using these coatings in any form.



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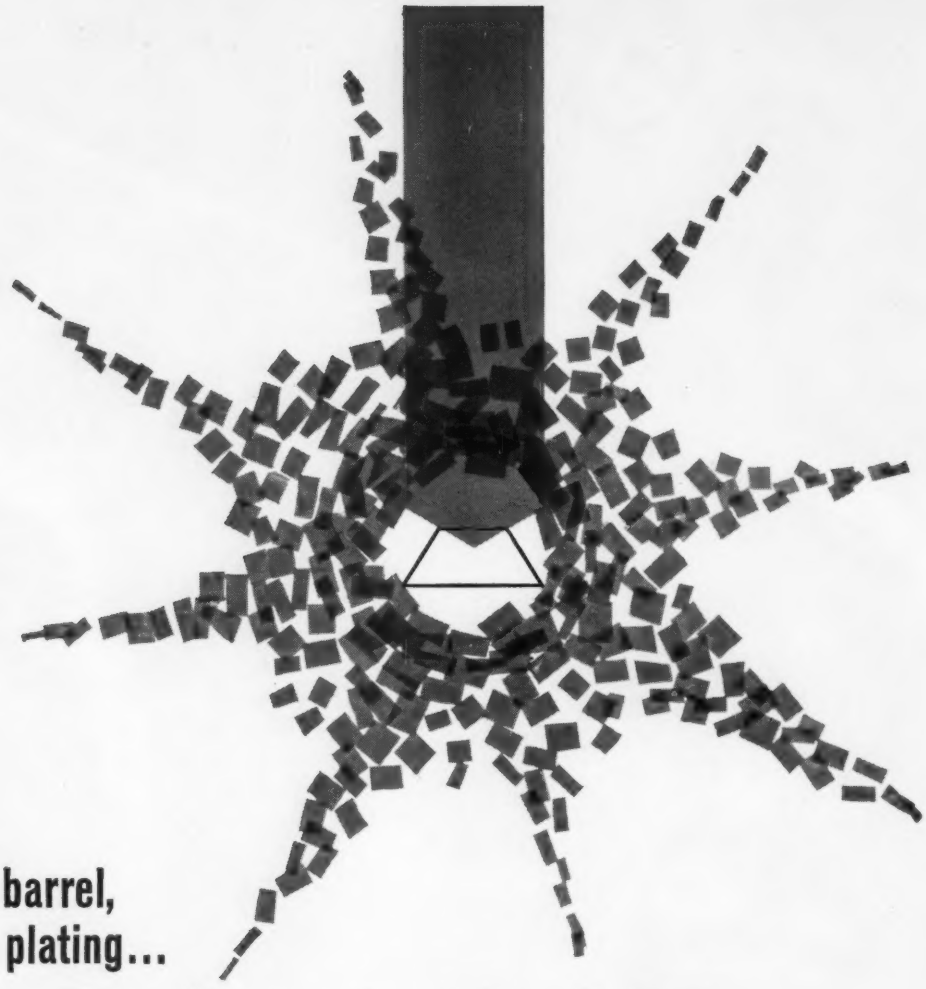

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MARCH, 1960 Volume 58 No. 3

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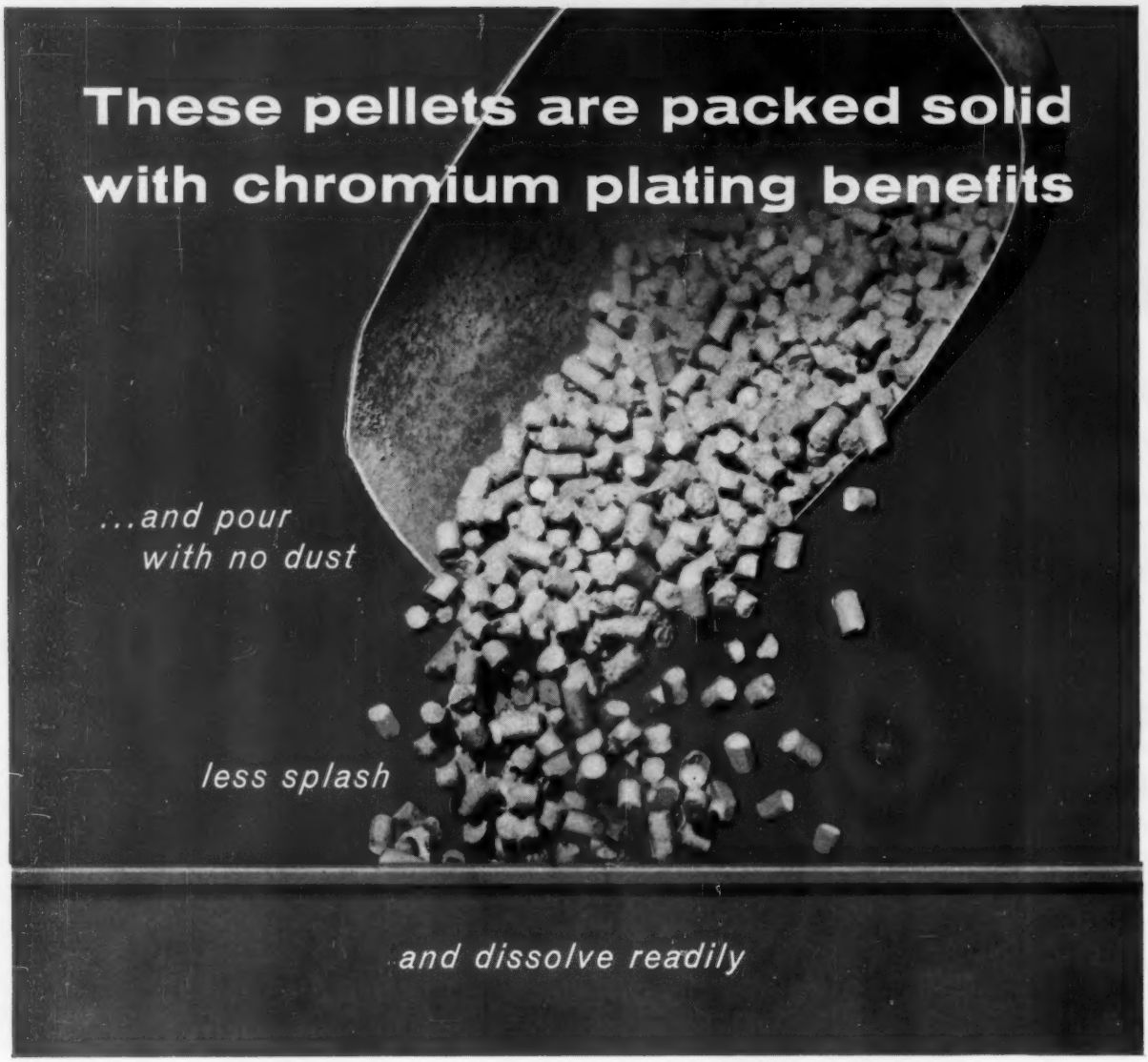

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NEW PLATING SYSTEMS

Recently, at a symposium sponsored by the American Zinc Institute in Detroit, a number of papers were delivered on decorative plating of zinc die castings for corrosion resistance in outdoor service, especially for the automotive industry, by far the largest user. The subject matter of these papers was not limited to the traditional nickel-chromium over a preliminary copper plate, but included the latest plating systems — high temperature, high ratio chromium; duplex nickel; chromium-nickel-chromium; nickel-duplex chromium, and duplex nickel-duplex chromium.

Proponents of each new system emphasized the advantages of their processes and generally ignored the disadvantages, a practice we have learned to accept with understanding resignation. Supporting data, in the form of results of outdoor exposure and accelerated corrosion tests, were offered to bolster their positions, and the principles on which these systems are based were expounded with unanswerable logic. This editor's enthusiasm mounted as he continued to study the papers, for it was obvious that segments of our industry really had the foresight needed to embark on such research projects. Now, we no longer would be restricted to thicker and still thicker deposits for improving service performance — for the first time we had other ways of obtaining the same results. Slowly, however, a disturbing line of thought began to intrude.

Here, we have different methods, all of which reach for the same goal and appear to approach it to about the same degree. Their superiority in improving corrosion resistance is undeniable, but — is one better than the others and, if so, which one? Many variables are involved in the production of a good finish, some beyond the control of the finisher. If a hitch should develop after the plating supervisor has committed his firm to a not-insignificant investment in one of the systems, and the results do not come up to full expectations, what then? The thought of having to make such a decision will not be conducive to peace of mind; it would have been so much easier had each of these developments arrived at more considerately spaced intervals instead of almost coincidentally.

As if this were not sufficiently disturbing, further study of the symposium papers disclosed that the marked superiority of duplex nickel compared with bright nickel of equal thickness, which is apparent in accelerated tests, was not confirmed in outdoor static and mobile exposure. This, together with other unbiased findings, suggests that any correlation at all between accelerated tests and coating quality is open to question, so that the choice becomes more of a gamble.

With the passage of time, we may accumulate sufficient performance data so that, if one of these systems or a combination is better than the others, it will have been proved incontestably. Until then, we can still hope that the ideal accelerated corrosion test for quality and service performance will materialize and solve all our problems.

Nathaniel Hall

Some Problems of an Accelerated Nickel Plating Process

By Larissa Domnikov, *Process Analyst A, Norair Division, Northrop Corp., Hawthorne, Cal.*

THE search for better and faster working electroplating processes occupies atttention of Russian researchers. One of the problems they attempt to find solution to is a more efficient nickel plating process. While on this side of the Iron Curtain a considerable amount of work has been done in developing such nickel baths as phosphate, pyrophosphate, sulfamate, and fluoborate, along with improving conventional sulfate and chloride baths, the Russians try some new approaches. The results of some of their investigations are described in an article by *G. S. Vozdvizhensky* and *R. S. Saifullin* published in "Bulletin of Institutes of the Ministry of Higher Education of the U.S.S.R.; Chemistry and Chemical Technology Series," No. 1, 1958.

In their attempts to develop a more efficient nickel bath, the authors have become interested in the use of ammonium salts. The following existing information served as a basis for their investigations. According to findings of another Russian researcher, ammonium ions favor the formation of fine-grained, fairly bright, and easy-to-polish deposits.[5] Nickel deposits obtained from baths employing ammonium salts as buffer additions[6,7,8] possess good mechanical properties. Ammonium sulfate is a very good conductor.[9] Ammonium ions prevent the precipitation of basic nickel compounds.[6,10,11] Due to the latter factor, it is possible to electrodeposit nickel at higher pH values (up to 7.0).[6,12] Nickel deposits formed from electrolytes containing ammonium ions possess a cubic lattice structure,[13,14] which may be one of the reasons for the improved brightness of the deposits and their better electropolishing characteristics.[15,16,17] In general, elastic nickel coatings (dull and bright) as a rule possess a cubic structure.[16]

A second phase of the authors' work envolved exploring the use of a reverse current as a means for obtaining bright nickel deposits. According to findings of a Russian scientist, Bakhvalov,[18] the use of a reverse current results in semi-bright and bright nickel coatings, the anodic dissolution of the coatings during the anodic period of the current being the factor responsible for the formation of bright surfaces. Other suggestions have also been offered.[19] Apparently, not every method of reverse current results in improved quality of coating. Thus, according to the results of other Russian researchers,[20] a sharp decrease in brightness as well as a decrease in adhesion take place in the anodic polarization of a nickel cathode. The formation of bright nickel deposits as a result of the use of a reverse current may be attributed to a periodic passivation of the surfaces.[21]

Accelerated Nickel Plating Process

PROCEDURE:

Nickel was deposited on mechanically polished copper and steel specimens, 2 by 4 cm. The average thickness of the deposits was 20 microns. The surface of the electrolytic nickel anodes was 2-3 times that of the cathodes. Reagents were of "chemically pure" and commercial grades, both being recrystallized prior to use. The structure of the deposits was studied on the etched cross-sections of the specimens. X-ray pictures were made with a copper K α radiation, at an angle of 26°, in cylindrical chambers. The brightness of the deposits was measured by means of a brightness-meter with a selenium photoelement. A silver mirror was used as a standard whose brightness was 100. The microhardness was measured on mechanically polished deposits. The internal stresses were measured on the basis of the degree of bending of a thin platinum cathode. The porosity was determined by the use of ferroxyl test. The throwing power was measured ac-

TABLE 1

	Temperature	40°C.		60°C.		75°C.	
	pH	1.85	2.40	1.85	2.40	1.85	2.40
Cathode current density amp./dm.²	Without agitation	4	2	5	3	7	4
	With agitation	10	8	12	9	15	11

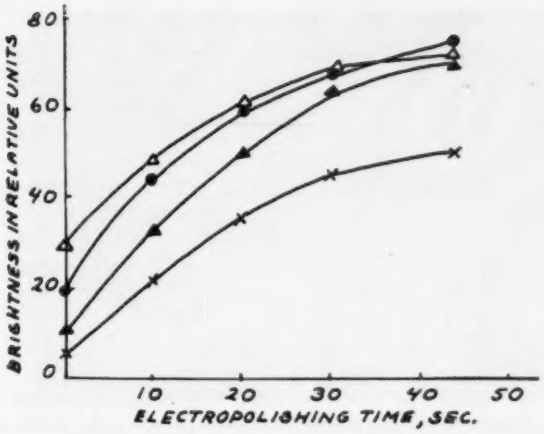

Fig. 1. Effect of solution temperature on brightness and electropolishing characteristics of deposits: 1—60°C.; 2—40°C.; 3—60°C. with the addition of 107 g./l. Na_2SO_4; 4—75°C.

cording to Field[9] on the basis of the current distribution between two cathodes removed unidirectionally from the anode 8 and 16 cm. respectively. The pH of the cathodic layer of the electrolyte was measured by means of a nickel-hydrogen electrode.[22] The pH of the electrolyte was measured by means of a quinhydrone electrode at 20°C. The reversal of current was accomplished by means of an electromagnetic relay at the rate of 0.005 second from impulses fed by a motor (60 rev/min). Another apparatus was used for the reversal of current at lower rates. The agitation was accomplished by means of a glass rod and, in measuring internal stresses, by means of a compressed air.

RESULTS:

The electrolyte contained 80 g./l. $Ni(NH_4)_2(SO_4)_2 6H_2O$. Table 1 gives current densities which resulted in first indications of burnt edges of the specimens.

The brightness of the deposits obtained without the agitation was 6-10 units, and that with agitation was 10-15 units at 40-60°C., and 1-6 units at 75°C.

The cathode efficiency varied over a wide range and, at the pH of 2.4, was equal to 80-90%. It decreased sharply with a decrease in temperature from 75°C. to 40°C. at a pH of 1.8 and varied within a 10 per cent range at the pH of 2.4. Agitation reduced the cathode efficiency (due to a decrease in the pH of the cathodic layer), and increase in current density increased the cathode efficiency.

The throwing power of the bath without agitation was within the range characteristic of conventional nickel electrolytes. It was reduced by the agitation.

The cathode potential varied from 0.70 to 1.05 volts (as compared to the potential of a saturated calomel electrode at 20°C.) within the range of current densities of 0.5-10 amp./dm.^{2}, temperatures of 75-40°C., and without agitation. Moderate agitation of the electrolyte reduced the polarization on the average of several dozen millivolts.

The pH values of the cathodic layer producing normal nickel deposits were in the range of 5 to 9. Such high values are given an explanation in the literature.[22] They are reduced by an increase in temperature, by the use of agitation, by a decrease in current density, and a decrease in pH of the electrolyte.

The anode solubility depends strongly on the electrolysis conditions. High temperatures, low pH values, and low current densities are the factors favoring anode efficiency. In order to maintain the composition and pH of the electrolyte, it is necessary to select a corresponding anodic surface for the given electrolysis conditions or else to add potassium chloride, up to 3 g./l.

The microhardness of the deposits was 300-500 kg/mm.^{2} It increased with an increase in current density and pH, and with a decrease in temperature. The hardness of the deposits in this study was somewhat higher than that of deposits from conventional electrolytes and was considerably lower than that of the bright nickel deposits.[23] The microhardness of the cross-section was lower than that of the surface, which can be explained by the difference in their structures.

Figure 1 shows the effect of the temperature on the brightness of the deposits.

Figure 2 compares the brightness and the electropolishing characteristics of the deposits obtained from various electrolytes. The following electrolytes were compared: 1—the electrolyte studied in this work, pH of 2.2-2.4; 2—a conventional sulfate electrolye, pH of 5;[9] 3—a Pasechnik electrolyte (350 g./l. nickel sulfate, pH of 2.0).[24] The cathode current density was 10 a/dm.^{2} The electropolishing of the deposits was accomplished in a 68.7% solution of sulfuric acid at 40°C. and D_a = 40a/dm.^{2} The brightness was measured on the same sample over certain periods of time (10-15 seconds).

As shown in Fig. 2, the deposits studied in this work possess a higher brightness and better electropolishing characteristics as compared to the other electrolytes.

Photomicrographs of the cross-sections of the deposits (Fig. 3), obtained at 10 amps./dm.^{2}, indicate that fine-grained deposits, whose structure resembles

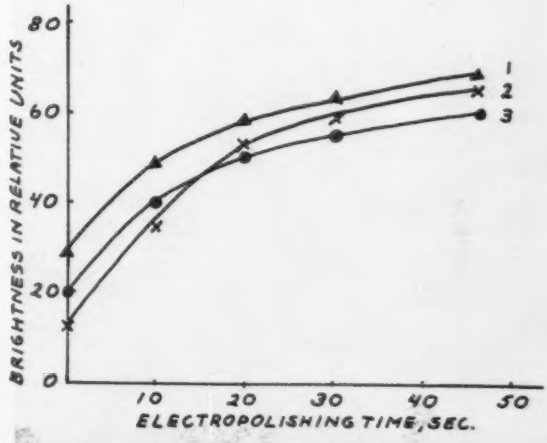

Fig. 2. Effect of nature of nickel electrolyte on brightness and electropolishing characteristics of deposits: 1—electrolyte studied in this work; 2—conventional sulfate electrolyte; 3—Pasechnik electrolyte.

that of the bright deposits, can be obtained under a wide range of conditions.[23]

The internal stresses were of the same order as those of conventional nickel coatings. They increased with an increase in current density, with a decrease in temperature from 60 to 40°C. (stresses increased 1.5-2 times), and with a decrease in pH from 2.4 to 1.8. Agitation sharply increased the stresses at a pH of 2.4, and insignificantly at a pH of 1.8. A sharp increase in the internal stresses as a result of an increase in the pH (at higher values of pH) began in the pH range of 6.8-7.2, whereas, with the conventional electrolytes, it occurs at a pH of 5-6.[23,25] This can be explained by the effect of the ammonium ions.

Porosity and pitting of the deposits were of the same origin as with the other nickel deposits. Adhesion to this basis metal (copper or steel) was very good even with coating thicknesses of 100-200 microns. Better quality deposits were obtained at a temperature of 60°C. and pH of 2.2-2.4. Under these conditions, a current density of 2-3 amp./dm.^{2} could be used without agitation, and a current density up to 7-10 amp./dm.^{2} could be used with agitation. Naturally, the above conditions can be modified. For example, the results of pilot plant tests indicated the advisability of using a somewhat higher pH (around 3) and a more concentrated electrolyte (up to 100 g./l. of salt). In spite of a widely held opinion[9] of poor mechanical properties of deposits obtained from electrolytes containing ammonium salts, the authors obtained deposits at low pH values and high temperatures which possessed quite satisfactory mechanical properties. Undoubtedly, under similar conditions, concentrated sulfate electrolytes would permit the use of considerably higher current densities, but the authors claim their electrolyte possesses certain advantages: it requires small amounts of nickel salt, is simple in composition, and can be easily controlled.

Role of the Structure of Deposits

The study of numerous x-ray pictures (two samples are shown in Fig. 4) allowed the authors to draw the following conclusions:

1. All factors reducing the cathode polarization favor the formation of deposits whose cubic plane is parallel to the plane of the basis metal (with some deviations). As a rule, the deposits are dull.
2. The deposits obtained at low temperatures, high current densities, low pH values, and without agitation do not possess cubic structure. However, they possess a certain brightness.
3. The deposits having good electropolishing characteristics do not possess cubic structure.

A number of recent studies[16,26,27] completely deny existence of a regular relationship between the structure and the properties of the deposits, even though the experimental data in the works of these authors[16,17] definitely reveal the effect of the cubic structure on the brightness and elasticity of the deposits. Apparently, in a number of cases, this relationship is hidden. The authors of the present study developed the following theory on the possible mechanism of disguise of the above relationship. Under the conditions reducing the cathode polarization, the originally formed grains grow freely, and the final deposits possess an oriented but relatively coarse-grained structure. Under the conditions of incomplete orientation, such a structure interfers more sharply with the regular reflection of light rays, and results in reduced brightness of the deposits. In addition, there arises an electrochemical non-homogeneity of the deposits, which considerably complicate the electropolishing conditions.

Possibly, in establishing a regular relationship between the structure of the deposits and their properties, one should take into account the crystal size of these deposits.

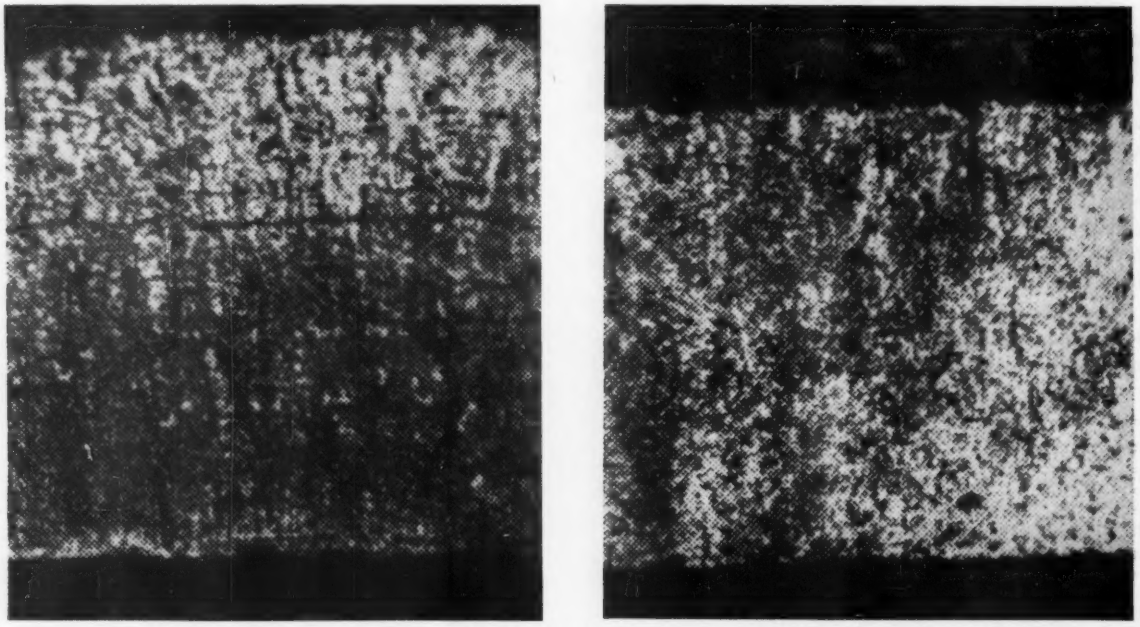

Fig. 3. Photomicrograph of cross-sections of deposits obtained at pH of 1.9: at 40°C.—(left); at 75°C.—(right).

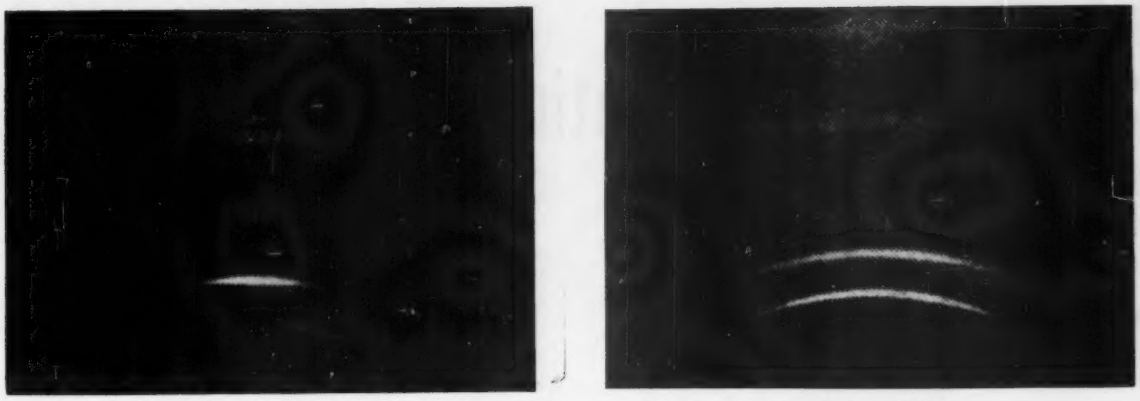

Fig. 4. X-ray pictures of the deposits: a cubic structure—(left); an irregular structure—(right).

Reverse Current Method

The authors failed to produce bright deposits under the conditions suggested by Bakhvalov[18] from their own electrolyte or the electrolyte recommended by Bakhvalov. A further study indicated that the basic condition for the formation of bright nickel deposits is not the anodic dissolution but the passivation of a freshly deposited coating during the anodic phase of the current. As a result of passivation, bright laminated deposits are formed. The conditions interfering with anodic passivation, such as the presence of chlorides, high temperatures, low current densities, low pH values, prolong the anodic period of the current necessary to produce bright deposits, or even make the latter impossible. Thus, under no conditions could bright deposits be formed from chloride electrolytes. The reversal of current has little effect on the internal stresses of the dull as well as of the bright deposits. The latter possess a higher hardness (up to 600 kg./dm.^{2}). The reverse current completely disorientates the deposited crystals which, in the absence of the reverse current, possess a cubic structure. Not all conditions of the reverse current produce bright deposits possessing good adhesion of individual layers. Exfoliation often takes place on bending the deposits, or even during the electroplating process. However, for a series of electrolytes, it is possible to select the reverse current conditions which would produce bright deposits possessing good adhesion properties. Thus, for the double salt bath, these conditions are as follows: 75°C., pH 2.4, c.d. up to 10 amp./dm.^{2}, use of agitation, every 30 seconds of electrolysis the current reverses its direction for 0.4-0.6 second.

Summary

1. It was shown that, with the accelerated method, the nickel bath based on the double salt of nickel and ammonium can produce deposits satisfying the technological requirements.

2. The reasons for apparent discrepancy between the structure and some of the properties of the deposits were explained.

3. It was shown that the essential condition for the formation of bright nickel deposits directly from baths without brightening agents, in the reverse current method, is the passivation of the cathodic surface during the anodic phase of the current.

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Science for the Coatings Technologist

Part XV. Dispersion

By E. S. Beck

This is the first of a two-installment article describing dispersions (general principles, grind gauges, mixing). —Ed.

Introductory

WE are entering what is possibly the most-studied phase of paint technology. It can also fairly be described as perhaps the least understood. There is a vast literature on the many aspects of the subject, for all to read. But there is also a tremendous amount of jealously-guarded know-how which remains the private possession of individual companies.

In paints, the prime function of dispersions is to incorporate the pigment into the vehicle. The pigment must be reduced to a size appropriate for paints. This will vary, of course, with the type of paint being made.

Usually, the pigment size should be well below the film thickness of the paint which is to be applied. In this way, particles do not project through the film and destroy the gloss and other properties.

Within limits, the color development is improved as the larger pigment aggregate are reduced in size. This is a principal reason for preparation of pigment dispersions.

Other materials besides pigments are frequently dispersed in the preparation of paints. Vinyl resins of large molecular weight are often used dispersed in non-solvent. This category of products will be considered when we take up plastisols and organosols. A special type of varnish is also used in dispersion form, and will be discussed under dispersion resins.

We will consider only the dispersion of pigments in vehicles in this paper.

Dispersion, in itself, is nothing more than the distribution of one finely-divided substance within another substance which is continuous. This, of course, is in most general terms. The specific case most often encountered in the paint industry is that of the dispersion of a finely-divided solid throughout a liquid. Other dispersions exist, naturally. The case of solids dispersed in gases is considered under the topic of smokes. Liquids dispersed in liquids are termed emulsions. But our interest will be almost exclusively in dispersions of solids within liquids.

Now the terms dispersion implies many things. It is taken for granted that the dispersed substance is very finely-divided. Actually, a mixture of coarse sand and water constitute a dispersion under some circumstances. These would be very fleeting except under heavy and continuous agitation.

The dispersion is also considered to be uniform. This is, the same amount of dispersion solid is expected to be present in every part of the liquid phase. No practical dispersions meet this expectation completely, as paints settle and emulsions cream. But useful dispersions, which are uniform or near-uniform at the time of actual use, are well within our reach. Paints can be made which do not settle for years; or which settle softly and can be easily redispersed.

It is also expected that dispersions will have some measure of stability. Certainly those used in paints must stay dispersed for extended periods of time. We are not thinking about settling now, but the process of agglomeration, or flocculation. This is the formation of large particles through coalescence or adhesion of smaller ones. These agglomerates, while actually loose associations of smaller particles, act as though they were individual large particles. Their presence in any large amount in a paint destroys the coverage, gloss, and even the film continuity. Their total absence is a much-desired but practically unattainable condition.

Each of these factors will be considered at the proper place. In the paint world, the operation of producing dispersions is widely called grinding; and the finished dispersions are regularly called grinds. The use of these terms has come under heavy criticism in recent years. This is because the expression "grind" carries the implication of a reduction in particle size, such as the grinding of wheat kernels into flour.

In the overwhelming majority of pigment dispersions no true reduction in ultimate particles size takes place. This is because the pigment is produced in adequately small particle sizes by the pigment manufacturer. The pigment, however, is prepared in wet state, and during the drying-out the small particles agglomerate into larger associations. It is these which must be broken apart during the grinding operation, restoring the original small particle.

For this reason, purists decry the use of the word grind in paint technology. In the opinion of the writer, the word grind is quite suitable and acceptable, and will be frequently used in the course of this article. In the first place, its meaning is well-understood, and the word has the advantage of long-established usage. In the second place the term grind means not only to reduce in size, but also to do work upon, in

the sense of exposing the material to the fractional and shearing action of one surface moving upon another. And this is a good description of the grinding process in the paint industry. Finally, there is an actual reduction in particle size if the agglomerates are considered as particles, which is justifiable.

It must be pointed out that reduction in particle size is not always wanted or desirable. In the case of extenders, there is nothing to be lost as the particle itself is reduced in size. There is a gain in smoothness and uniformity of appearance of the dry film. But many color pigments are unfavorably affected if ground in such a way that the size of the basic particle or the crystal is reduced. The color usually depends upon the crystal form of the pigment. Fracture this, and the color will change. Most of the ordinary pigments have basic particles or crystals which are so small there is little danger of fracturing them without deliberately setting out to do so.

There are some, however, with larger particles which are easily broken; and in these cases care must be observed. An example is the very red molybdate orange pigment, often called molybdate red. The particles of this pigment are rather large, and easily friable. Real care must be taken in the preparation of dispersions using molybdate red, or the color, and other properties will be altered.

The reference to other properties is based on the fact that many (if not most) pigments are now surface-treated to obtain various properties such as lightfastness, freedom from chalking, etc. If the crystal is broken, untreated edges will be exposed which will lack the protection of the surface treatment. To the extent that the crystal is boken up, the protective properties will be lost. It is not impossible with some pigments, to lose the properties of the surface treatment almost entirely.

Other pigments which lose value if overground are luminescent pigments, which work best when relatively coarse. Some pigments, such as iron blue, which is relatively transparent, become completely transparent upon being sufficiently finely dispersed. This may be an advantage or a drawback depending upon the properties desired.

We are taking up the subject of dispersion in this series as an interruption of the consideration of additives. Some may feel that it is out of place here. Dispersion often is thought of in terms of machinery or a mechanical process. It is that, to a certain measure; but it is also much more. It is not easy to assign the subject of dispersion to any specific area, so broad are its ramifications.

But there are no practical dispersions which are made without the processes of wetting and deflocculation and suspension. These effects are obtained by the presence of substances which promote them. They may be naturally present or deliberately added. But they are indispensible. In terms of additives, they include surface active agents (on the pigment as a treatment or added to the grinding mix) dispersing agents and suspending agents.

It is not feasibly to prepare a dispersion of pigment in an organic solvent. The author knows of only one such, a colloidal hydrated iron oxide. If such dispersions were available, they would be of very great utility in the paint field. They would provide a means of introducing pigment into a wide variety of compositions without problems of compatibility. But if into the mixture of pigment and solvent a small amount of wetting or dispersing agent, such as soya lecithin or aluminum octoate, is introduced, preferably with some resinous material, although this is not essential, a good dispersion can be produced, under precisely controlled conditions.

This demonstrates the value of additives in dispersions. The fact that substances must be present to promote wetting before dispersion can be obtained is the reason that the subject is taken up at this point. Any substance used to improve the wetting, as well as to promote dispersion and suspension can be considered as an additive in that respect, even though it is a major constituent of the coating in other respects. Thus, one or two per cent of bodied linseed oil can serve as a surface active agent, and no more is needed for that purpose, even though large amounts in addition are used as the binder of the formulation.

In this article, we will consider all aspects of dispersion, including the value of individual materials and additives. The care and handling of dispersions will also be discussed. The quality of a dispersion is frequently blamed for poor results when the method of handling is the true cause of failure. Individual processes of dispersion, and the machines to produce dispersions will also be taken up.

The Dispersion Process

Pigments are dispersed into vehicles to produce coatings of specific color, hiding power, gloss, and performance properties (such as corrosion- or mildew-resistance). In general, a good degree of dispersion must be produced. If not, depending on the degree of dispersion obtained, the coating will be gritty, non-uniform in color, streaky, and often nonfunctional in some important respect.

Often there are three mechanical steps in the preparation of the dispersion: a premix, the actual grinding operation, and the reduction or let-back operation. The premix is of varying importance, being essential for roller mill and sand-grinding but often omitted in closed-mill grinding. The other two operations are indispensible, except in a few specialized cases of no practical importance.

In almost every case, a large amount of work must be done on the paste in order to obtain an excellent dispersion. What is most needed is a shearing action, to aid in breaking up the agglomerates of pigment. This action is at a maximum at high viscosities. Consequently when very good dispersions are required, it is advisable to work on the paste in a heavy consistency.

For example, in the case of titanium dioxide, a relatively easy pigment to disperse, the highest gloss can be obtained only by those processes which do

very heavy work on pastes of high viscosity. First among these is the chip mill or rubber mill (sometimes called the two roll mill). Then the heavy-duty sigma-blade mixer or dough mixer or its close relative the Banbury mixer, then the roller mill. While acceptable whites can be made on the pebble mill, this mill cannot deliver the high gloss of the others mentioned.

Pre-Mixing

While the value of pre-mixing has only recently been demonstrated in a scientific manner, old-time procedure usually called for an aging of the paste before grinding. This was called "sweating" the paste. This standing (usually 24 or 48 hours) allowed the liquids to wet down the pigment more thoroughly, and resulted in smoother finished products.

Even superior results can be obtained by subjecting the paste to intensive mixing instead of prolonged standing. For roller-milling the mixing is done in lead mixers, sigma-bladed mixers or other similar equipment. The paste should be as heavy as the mixer can handle. The trend in recent years has been to increase the power of these mixers in accordance with the need for mixing at high viscosity.

It is surprising how much dispersion can be obtained during the premixing. If the pigment is of the easy-dispersing sort, and the pigment-vehicle ratio is properly adjusted, often finished dispersions can be made during the mixing operation. Of course, such dispersions are not suitable for high-grade enamels.

It is generally considered that closed-type mills, such as steel ball mills, do not require a premixing operation. The pigment and liquids are all loaded into the mill. The mill is then closed and the rotation begun. But it can be shown that many grinds are improved even in closed mills when a premixing technique is employed. In most cases, the premix consists of running the pigment with some solvent and a surfactant. This is somewhat equivalent to starting with a surface-treated pigment.

Grinding

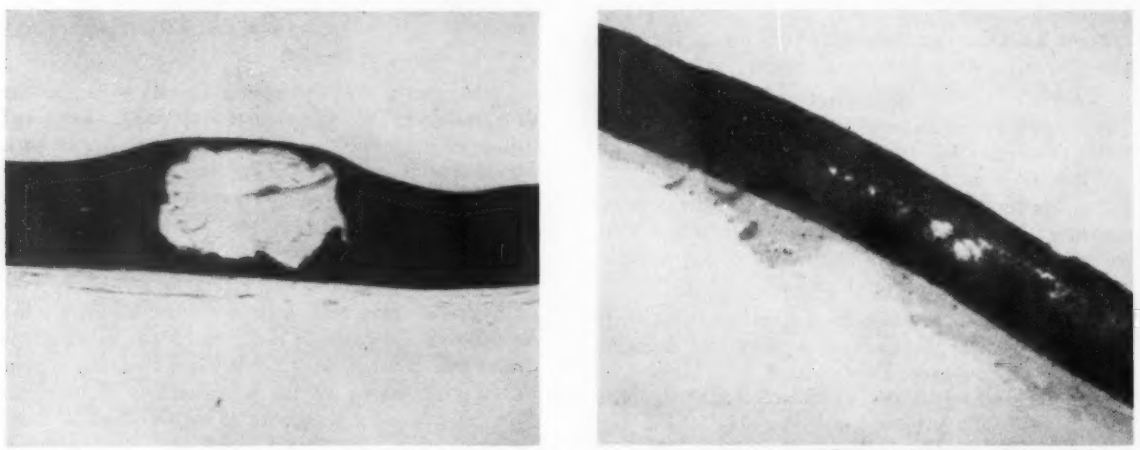
This is the process by which the actual dispersion is completed. In general, the greatest amount of work is done upon the mix during the grinding operation. Part or all of the wetting will be done during the pre-mix stage if there is one. The balance of the wetting will take place during the grinding, as will most of the deflocculation or actual dispersion.

If the actual pigment agglomerates in the dry state are considered as being similar to a cluster of grapes, the deflocculating action is equivalent to separating the cluster into individual grapes. Returning to the particle-agglomerate point of view, the particles are formed into roughly spherical shapes with each individual particle surrounded with air. The air must be displaced by vehicle, sometimes a very difficult operation. This is the wetting phase. It occurs before or simultaneously with the dispersion phase.

Once the agglomerates have been wetted and dispersed, the remaining problem is to keep the particles from reflocculating back into clumps once more. This is done in a number of ways. One is by charging the pigment particles alike, so that they repel each other. This is generally done by use of lower surfactant dispersing agents.

Another way of reducing the tendency of the particles to agglomerate is by lowering their mobility. This is best accomplished by increasing the viscosity of the paste. The most acceptable method is by using a high vehicle solids content. In the case of chip dispersions, the viscosity of the chips is so high that they are hard solids. And the stability of the dispersion in this form is very high.

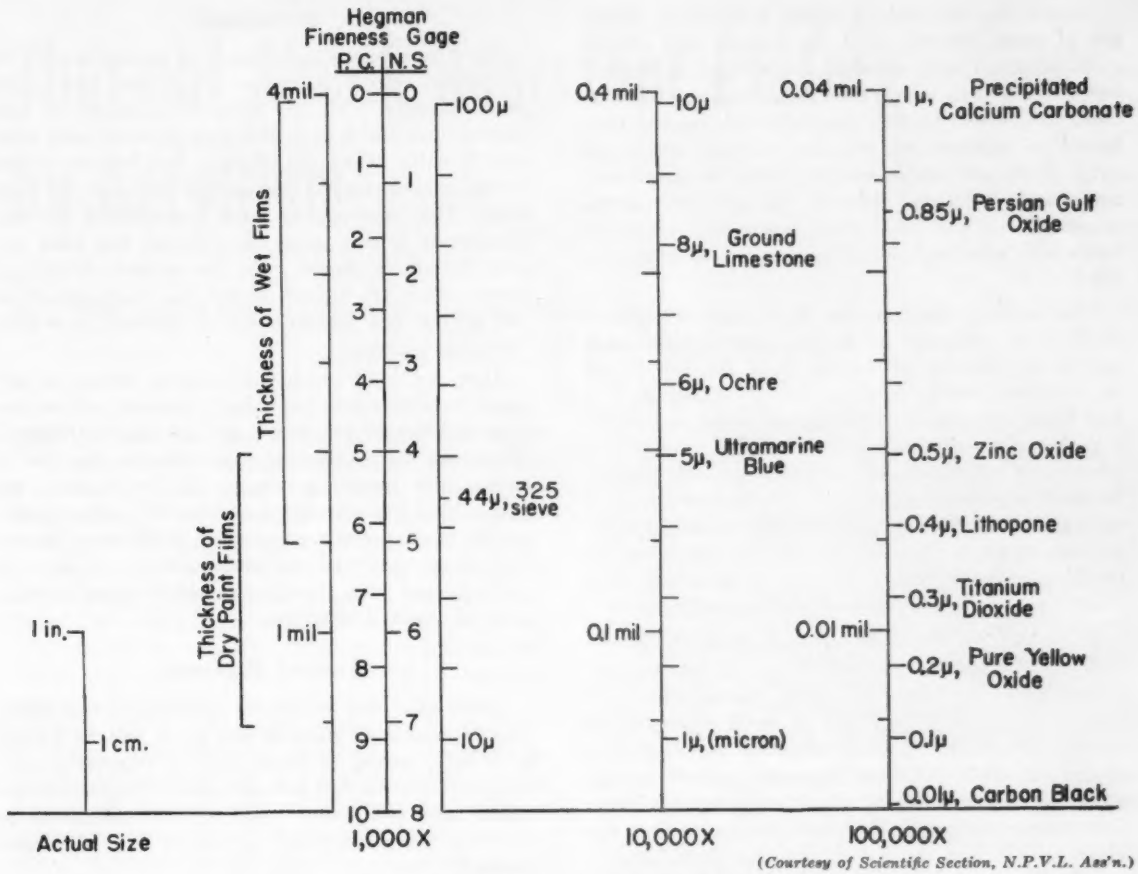
In general, those forms of dispersion, such as roller mill and Banbury mill which use high vehicle solids are very stable. Those which use low vehicle solids, such as ball mills, are unstable. In the latter case, it is best to add additional vehicle as soon as the grind has been completed. This will aid in the stabilization of the dispersion, but in general ball



(Courtesy of American Cyanamid Corp.)

Figure 1. Enamel Cross-Sections.

Both of these photomicrographs represent dispersions of Titanium Dioxide. Figure 1a shows a film with poor texture. The aggregate of pigment is large and produces a bump in the film. The binder is thin above and beneath the bump. Figure 1b shows a film with good texture. There are some aggregates, but they are small and have not affected the levelness of the film. In both illustrations, the pigment aggregates have been removed during the preparation of the cross-section, so that we are looking at the void left by the aggregates.



(Courtesy of Scientific Section, N.P.V.L. Ass'n.)

Figure 2. Comparison of Grind Gauge Readings with Pigment Particle Sizes.

mill dispersions are not as stable as roller mill grinds, no matter how they are treated.

Reduction

The dispersion is prepared only as an intermediate material. Rarely is it the final product. Its use is in the preparation of finished paints; and in general it is the best policy to get it into the paint as soon as possible. Even the best and most stable dispersions do not improve on aging; and most deteriorate on standing.

In the case of ball mill and pebble mill grinds, the reduction or let-back into final state should take place as soon as the mill is emptied. If the formula permits, it is good practice to finish right in the mill, and draw off finished material.

Where this is not possible, the ball mill dispersion should be stabilized by the addition of a substantial amount of vehicle. It is best to add this while the charge is in the mill. If it cannot be done, the let-back with vehicle should be slow and cautious, to avoid kick-out by shocking the pigment particles.

The danger of kick-out on making adds to the dispersion is less with high-vehicle grinds. Nonetheless, it is good practice to exercise great care in letting back any dispersion. The main principle to follow is to begin the let-back with vehicle at the highest viscosity and solids possible, in order to maintain a good rate of shear. This, of course, calls for mixing machinery with high power.

Solvent Selection

Some recent work on this subject is of great importance. The type of solvent used is, of course, of importance from the point of view of its solvency for the vehicle being used. It would be impossible for example, to use an alcohol as a solvent for vinyl copolymer, regardless of the other virtues it might display from the point of view of dispersion.

However, in the overwheming majority of cases, there is a good choice of permissible solvents or solvent blends. And it is here, in the choice of the proper solvent for use in the dispersion, that a surprising amount of good can be done.

Daniel[1] in a study of solvents used in dispersion compared mineral spirits, odorless mineral spirits and xylol in dispersions of titanium dioxide in alkyd resins. He showed that when the dispersion was prepared in the solvent of lowest cutting power (or K.B.) namely odorless mineral spirits, best results were obtained. Stronger solvents in the dispersion promoted seeding and pigment shock, while weaker ones were relatively free of these failures. Thus, where there is a mixture of solvents in the formulation, the grind should be prepared in the one of lowest solvency, and the higher-powered solvent reserved for the let-back.

Some of the data and explanations offered by Daniel are of great interest. First, he showed that dispersions prepared with odorless mineral spirits showed less seeding than when xylol or mineral spirits was used. He showed further, that when the coating contained a mixture of odorless mineral spirits of xylol, there was severe seeding when the grind was made using xylol and reduced with odorless mineral spirits. There was no seeding when the grind was made with odorless mineral spirits and reduced with xylol.

This seeding, which is the final stage of pigment shock, was postulated to be pigment agglomeration caused by transfer of solvent from the grind into the let-down vehicle. A series of experiments showed that there is indeed a shriveling, serrating and cracking of a dispersion when a clear vehicle containing solvents of decreased strength was poured over it. When the dispersion contained odorless minieral spirits, and the clear vehicle contained mineral spirits, a tough skin was gradually formed, but there was no cracking or serration. In both cases, there was what could be called drying-out of the dispersion.

The migration of solvent was undoubtedly in accord with the physical conceptions of osmosis. The concentration of solvent is low in the supernatent alkyd and high in the dispersion. Hence, a rapid migration of solvent into the alkyd from the grind, resulting in a drying-out. This dried-out dispersion, when broken up by agitation, produces the so-called seeds. (There is a reverse motion of alkyd resin molecules from the clear vehicle into the grind, but this is so slow it can be disregarded.) Seeds are more often produced by the drying-out of small droplets of the dispersion suspended in the clear alkyd during the let-down process.

This is the reason why high-solids clear vehicle should not be allowed to remain in contact with the dispersion for any considerable period of time. The mixing should be prompt, and the vehicle adds gradual, with much agitation during the process.

By consideration of the surface tension of the various solvents studied, Daniel showed that the presence of a difference in surface tension produced a spreading or internal mixing effect, greatly augmenting the external or mechanical mixing effect. Best results, as already seen, were obtained when lower solvency thinner was used in the grind. The lower solvency thinners under discussion also possess lower surface tension, causing them to be slower in migrating into the concentrated vehicle phase. However, the surface tension effect is so desirable as a mixing aid that sometimes it is preferable to grind in higher solvency thinner rather than to have no surface tension difference at all. The safest and most efficient combination, however, remains the grind in odorless mineral spirits and let-back in mineral spirits.

Thus the seeding or agglomeration problem can be seen to be a matter of drying out of the paste. It should be emphasized that this problem is severe only with dispersions which are made at low vehicle ratios: closed mill grinds. This subject will be pursued further when we consider ball and pebble mills.

Surfactants

There are indeed a multitude of surfactants which have been offered and have found some use in the paint industry. They are generically known as wetting agents; and indeed, this may be their most valuable function. Once the pigment has become wetted by the vehicle, the hardest part of the work has been done. The breaking up and dispersal of the agglomerates is easy once the pigment has been wet and the air displaced from the surface. With pigments which are difficult to wet, the 'lion's share' of the mixing and milling work is devoted to wetting down the pigment.

Thus, anything which will promote wetting is welcome in dispersion technology, provide, of course, that undesirable properties are not also introduced. There are three principal approaches to the use of surfactants: treated pigments, chemical surfactants, and normal ingredients selected for dispersing power. In the latter group are solvents, as discussed above, and some other special cases shortly to be considered; and some binders, especially good wetters, such as rosin derivations.

Treated Pigments

These have been considered elsewhere in this series. Our discussion of them at this point will be limited to a brief survey of their place of dispersion technology. There are two general classes of pigment treatments from our present point of view: treatments to improve wettability, and treatments for other purposes.

The treatments for other purposes are usually to improve light-fastness or durability, and do not concern us here. Examples are the silica or antimony treatments on the surface of titanium dioxide.

Treatments to improve wettability are most useful on hydrophilic pigments such as black, calcium carbonate and titanium dioxide. They are less valuable on hydrophobic pigments, such as many red and other organic pigments. This assumes, of course, that the pigment is to be wetted by non-polar solvents and resins, or ones which at least have large hydrophobic ends to the molecule. This would include oils, natural resins (except hydrocarbons), alkyds and most other materials. Very non-polar resins include chlorinated rubber, vinyl copolymer resins, hydrocarbon resins, and some others.

These non-polar resins are usually poor grinding substances because of lack of wetting power. Theoretically, they should disperse hydrophobic pigments with ease. This may hold true in some cases, but surprisingly, hydrophobic pigments treated for better wettability seem nonetheless to disperse more readily in hydrophobic vehicles than do untreated pigments.

The value of treated pigments has been demonstrated so fully, that a large percentage, if not a majority, of prime pigments have been surface treated today. While wetting and dispersion are made easier by means of the treatments, the need for careful formulation of dispersions has not been eliminated. Nor do treatments obviate special surfactants or dispersing techniques in many cases.

Thermal Shock Resistant Plating on Beryllium

By L. Missel, *Lockheed Missiles and Space Division, Sunnyvale, California*

USE of commercially pure beryllium in experimental missiles showed a need for surface improvement on parts made of this metal. A plated surface was needed for corrosion protection in contact with dissimilar metals and under test-base storage conditions, and protection in flight under rigorous conditions of thermal shock, to extend the applicability of the metal. Much beryllium for structural use is produced by powder metallurgy techniques and has an inherent roughness which cannot be improved substantially by polishing and buffing. Corrosion characteristics of beryllium are analagous to those of aluminum. Resistance to catastrophic oxidation at elevated temperatures is better than that of aluminum, though not enough better to eliminate the need for protection. Commercial beryllium has poor ductility and poor impact strength, but has the advantages of high meting point (2341°F.), high strength, good strength retention at high temperatures, high hardness for a light metal and light weight (specific gravity 1.85).[1] This combination of higher melting point than other light metals, very high strength to weight ratio, and favorable high temperature properties makes beryllium of great interest in specialized applications. It is likely that the use of this metal will became inceasingly important in many airborne applications.

Previous experience in plating over copper[2] indicated that nickel deposited from a sulfamate bath over a properly prepared surface could be produced essentially pit-free, and was capable of withstanding thermal shock. This plating was capable of being taken to an extremely high polish (1 microinch RMS). Consequently, all work on coating the beryllium was directed toward adherent plating of nickel from the sulfamate bath to take advantage of the same desirable coating properties of nickel previously experienced with nickel over copper.

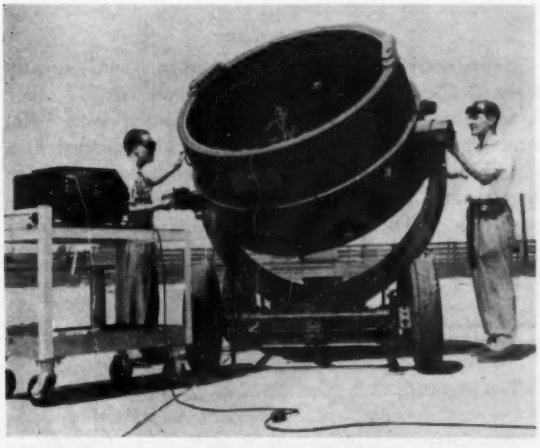


Fig. 1. Solar Furnace.

Fig. 2. Test sample plated with 0.007" nickel after 2 seconds solar furnace exposure. Blistering indicates that activation of the beryllium was unsatisfactory. (Table II, #1)

Fig. 3. Test sample plated with 0.007" nickel after 9 seconds solar furnace exposure. Beryllium melted causing cracking in nickel, but plate could not be lifted. (Table II, #8)

The previously published methods of Beach and Faust[3] and of Kolodney[4] for plating on beryllium were evaluated. While they yielded nickel plating of excellent appearance, the adhesion of the deposit to the basis metal was insufficient to prevent blistering when subjected to thermal shock in the solar furnace. (Fig. 1.) This solar furnace test,[2] consisted of focusing the sun's rays reflected from a 60-inch parabolic mirror on a clear, sunny day to a spot 1/8-inch in diameter on a small plated sample disc. Despite the great heat

Fig. 4. Test sample plated with 0.007" nickel after 10 seconds solar furnace exposure. Molten beryllium bubbled through one small spot, but plate could not be lifted. (Table II, #9)

Fig. 5. Test sample plated with 0.007" nickel after 7 seconds solar furnace exposure (just short of melting the beryllium). Nickel darkened, but no evidence of failure. Activation of the beryllium satisfactory. (Table II, #21)

absorption due to the great bulk of the sample in comparison with the small heat-affected area, it was possible to cause the beryllium to melt and bubble through a polished 0.007-inch coating of adherent nickel in approximately nine seconds.

It was obvious from the solar furnace tests that a new method of preparation of beryllium for plating was required. The thermal shock resistance of the final plating system developed was thoroughly checked by this method; even more important, a number of plated parts were used and found in practice to produce excellent results in the severe environments experiencd by components in Lockheed-built research missiles. Such plated parts were not found to require a baking treatment, nor to exhibit spontaneous cracking as described by Beach and Faust.[3] Specimens plated by the author approximately two years ago show no evidence of deterioration despite lack of baking. Both the thermal shock tests and use tests involved an exposure to intense heat for short periods of time. No evaluation was made of extended-time heat resistance at lower temperatures, where plating destruction due to alloying with beryllium has been reported, since it was of no interest for the desired applications.

Had the thermal shock resistance been inadequate experimentally or in practice, a layer of iron, which is considerably more resistant to high temperature diffusion of beryllium, would have been interposed between beryllium and nickel.

Experimental

All experimental plating was performed on ½-inch round discs, ⅜-inch thick, fabricated from stock of the composition given in Table I. This is a typical commercially pure beryllium. Electrical contact was made through a screw inserted in a tapped hole in the side. The back face and a small area adjacent to the contact were masked with ceresin wax. The plated face was polished to 1 microinch RMS after plating, and this smooth face was solar furnace tested. It is of interest to note that the polished face of the disc was merely darkened during solar furnace testing when adherent nickel was applied and the beryllium heated to temperatures short of the melting point, but the rougher, as-plated side was severely oxidized despite its greater distance from the heat source.

It soon became apparent that a very satisfactory solution to the problem of obtaining adhesion adequate to provide thermal shock resistance was pretreatment with approximately 10% (by volume) sulfuric acid or, to a lesser extent, approximately 20% (by volume) fluoboric acid. A treatment in 5% nitric—1% hydrofluoric acid (by volume) before the sulfuric or fluoboric acid treatment provides excellent cleaning, a very uniformly etched surface and some additional thermal shock resistance. However, quite good thermal shock resistance usually can be obtained even if this step is omitted entirely. The hydrofluoric-nitric treatment is not applicable as a final pre-treatment.

Proper mechanical preparation is very necessary before chemical treatment, particularly with commercial beryllium surfaces currently available. For this purpose, sanding with wet #400 emery paper will give good results. Because of the extreme toxicity of beryllium, and particularly beryllium dust, adequate safety precautions must be taken. Details of these precautions are beyond the scope of this paper.

TABLE I

Assay (Be)	98.7	Cr	.013
Be	1.62	Co	.0003
Fe	.15	Be_2C	.20
Al	.042	Si	.060
Mn	.012	Cu	.003
Ni	.014	B	.9 ppm

Analysis by Brush Beryllium Corp.

Procedure

Referenced methods[3,4] were run on mechanically cleaned discs as per the author's procedure. All other samples and parts were first wet sanded with #400 emery paper, rinsed and then anodically cleaned in a mild brass type cleaner at 130°F. and 50 amp./ft.² for five minutes. After rinsing, they were further treated as per Table II. The copper strike of Table II was operated as follows:

Copper (as metallic copper)	1.5- 2.1 oz./gal.
Free sodium cyanide	1.3- 1.5 "
pH (adjusted with sodium hydroxide)	12.0-12.6
Temperature	100°-110°F.
Current density	As Indicated

The nitric-hydrofluoric acid, sulfuric acid, sulfamic

TABLE II

Experimental Data

	Preplating Preparation	*Baking*	*Solar Furnace Expos. (Sec.)*	*Solar Furnace Test Results*	*Remarks*
1.	Beach & Faust, Direct Plating Method[3]	17 hrs. at 275°F.	2	Blistered	(Fig. 2)
2.	Beach & Faust, Direct Plating Method[3]	17 hrs. at 275°F.	2	Blistered	
3.	Beach & Faust, Zinc Immersion Method[3]	17 hrs. at 275°F.	2	Blistered	
4.	Kolodney[4]	17 hrs. at 275°F.	2	Blistered	
5.	Beach & Faust, Copper Cyanide Bath #II[3]	18 hrs. at 300°F.	3	Blistered	
6.	(a) 5% HNO_3 — 1% HF, 30 seconds-rinse (b) Copper strike, 2 min., 120°F., 25ASF, rinse (c) 2% Sulfamic Acid, 15 sec., rinse (d) Plate	18 hrs. at 350°F.	3	Blistered	
7.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) Plate	18 hrs. at 350°F.	3	Blistered	
8.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 15 sec., rinse (c) Plate	18 hrs. at 350°F.	9	Beryllium melted, but no evidence of blistering. Plate cracked but could not be lifted.	(Fig. 3)
9.	(a) 5% HNO_3 — 1% HR, 30 sec., rinse (b) 10% H_2SO_4, 15 sec., rinse (c) Copper strike, 60 sec., 100 ASF, rinse (d) 10% H_2SO_4, rinse (e) Plate	18 hrs. at 350°F.	10	No evidence of blistering. Molten beryllium bubbled through one small spot.	(Fig. 4)
10.	(a) 10% H_2SO_4, 15 sec., rinse (b) Plate	18 hrs. at 350°F.	7	Excellent	
11.	(a) 10% H_2SO_4, 60 sec., rinse (b) Plate	18 hrs. at 350°F.	5	Excellent	
12.	(a) 10% H_2SO_4, 15 sec., rinse (b) Copper strike, 60 sec., 100 ASF, rinse (c) 10% H_2SO_4, rinse (d) Plate	18 hrs. at 350°F.	5	Excellent	
13.	(a) 10% H_2SO_4, 15 sec., rinse (b) Plate	18 hrs. at 350°F.	6	Burn through	Previously plated sample-stripped with fuming HNO_3
14.	(a) 10% H_2SO_4, 60 sec., rinse (b) Plate	18 hrs. at 350°F.	6	Excellent	Previously plated sample-stripped with fuming HNO_3
15.	(a) 10% H_2SO_4, 90 sec., rinse (b) Plate	None (aged 7 days)	8.5	Excellent	Previously plated sample-stripped with fuming HNO_3
16.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 60 sec., rinse (c) Plate	None (aged 8 days)	7	Excellent	Previously plated sample-stripped with fuming HNO_3

(*Table II continued on next page*)

TABLE II *(continued)*

	Preplating Preparation	*Baking*	*Solar Furnace Expos. (Sec.)*	*Solar Furnace Test Results*	*Remarks*
17.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 20% HBF_4, 15 sec., rinse (c) Plate	None (aged 6 days)	7	No burn through but slight unevenness	
18.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 20% HBF_4, 30 sec., rinse (c) Plate	None (aged 2 days)	6	Excellent	
19.	(a) 10% H_2SO_4, 15 sec., rinse (b) Plate	None (aged 6 days)	7	Excellent	
20.	(a) 10% H_2SO_4, 20 sec., rinse (b) Plate	None (aged 8 days)	7	Excellent	
21.	(a) 10% H_2SO_4, 60 sec., rinse (b) Plate	None (aged 6 days)	7	Excellent	(Fig. 5)
22.	(a) 10% H_2SO_4, 15 sec., rinse (b) Cu strike, 60 sec., 100 ASF (c) 10% H_2SO_4, rinse (d) Plate	None (aged 14 days)	5	Excellent	
23.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 15 sec., rinse (c) Plate	None (aged 6 days)	7	Excellent	
24.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 15 sec., rinse (c) Plate	None (aged 8 days)	7	Excellent	
25.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 60 sec., rinse (c) Plate	None (aged 8 days)	7	Excellent	
26.	(a) 5% HNO_3 — 1% HF, 30 sec., rinse (b) 10% H_2SO_4, 60 sec., rinse (c) Cu strike, 60 sec., 100 ASF (d) 10% H_2SO_4, rinse (e) Plate	None (aged 8 days)	7	Excellent	
27.	(a) 5% HNO_3 — 1%, 30 sec., rinse	None (aged 14 days)	9.6 (1600°F.)*	Excellent	Discs with thermocouples
28.	(b) 10% H_2SO_4, 30 sec., rinse	None (aged 14 days)	9 (1400°F.)*	Excellent	
29.	(c) Plate	None (aged 14 days)	11 (1600°F.)*	Excellent	
30.	(a) 10% H_2SO_4, 30 sec., rinse	None (aged 14 days)	11.4 (1700°F.)*	Excellent	Discs with thermocouples
31.	(b) Plate	None (aged 14 days)	9.3 (1500°F.)*	Excellent	
32.		None (aged 14 days)	12 (1800°F.)*	Minute burn through Beryllium boiled violently. Complete plate failure	

*Temperatures recorded by thermocouples brazed into recess in rear face of disc. Because of temperature gradients, the small area of heat application (approximately ⅛" diameter), and very questionable focusing of solar furnace beam directly over thermocouple area these temperatures are undoubtedly far lower than the maximum spot temperature.

(Courtesy Autonetics Div., North American Aviation, Inc.)

Fig. VI. As-plated component (12" diameter). This item was directly plated with 0.007" nickel for Autonetics Div., North American Aviation, Inc., and surface mechanically finished to 1 micro inch RMS maximum roughness before use.

acid, and fluoboric acid were used at room temperature.

After indicated treatment (Table II) the metal was plated (approximately 0.007" Ni/side) in a proprietary all-sulfamate nickel plating solution as follows:

Density	30.0-31.50° Baumé
Boric acid	4-5 oz./gal.
pH	3.0-3.5 (electrometric)
Surface Tension	80-120% of proprietary formulation
Stress Reducer	None
Anodes	Bagged 99% plus, rolled depolarized nickel
Temperature	128°-132°F.
Current Density	50 amp./ft.^{2}
Agitation	Cathode Rocker

Beryllium is quite similar in its chemical reactions to aluminum. For this reason it was feared that extended rinsing, particularly after activation, might be deleterious to adhesion due to oxide film formation. However, experimental evidence indicates that adhesion does not suffer even when all rinses are as long as two minutes.

All baking was done under vacuum. It was noted at an early stage that the baking treatment described by Beach and Faust[3] resulted in no better solar furnace performance. Baking was consequently discontinued. Despite a desire to solar furnace check unbaked samples sooner after plating, practical difficulties and a temperamental sun made it impossible to do so.

Discussion

Samples plated, solar furnace tested, stripped with red fuming nitric acid, and replated, were found to require longer activation treatments to produce good adhesion. Stock removal by extended sanding also eliminated the necessity for longer activation treatment. It is felt that this was due to diffusion of nickel into beryllium during thermal shock.

It will be noted from Table II that good adhesion can be produced either by plating nickel directly, or over a copper strike. Both methods appear to be of equal value to produce good plating. Copper is a valuable undercoat for plating many other metals on beryllium.

The adhesion obtained was such that beryllium component, containing a large surface inclusion which was repaired by electroforming with nickel by this method, reached the point of failure under ultimate service conditions on the side opposite the repair.

TABLE III. *Plating Sequence*

1.	Abrasive clean	
2.	Rinse	
3.	Anodic clean	Mild Alkaline Cleaner
	Time	5 min.
	Temp.	130°F. Typical
	C. D.	50 amp./ft.^{2}
4.	Rinse	
5.	Acid Etch	5% Nitric Acid-1% Hydrofluoric Acid (by volume)
	Time	30 seconds
	Temp.	Room
6.	Rinse	
7.	Activate	10% Sulfuric Acid (by volume)
	Time	—30-60 seconds
	Temp.	—Room
8.	Rinse	
9.	Plate	

Acknowledgement

The author wishes to acknowledge the valuable help of *Frank Bolton*, under whose direction the solar furnace tests were run.

This work was done at and for Lockheed Missiles and Space Division to whom a patent application covering above has been assigned, and with whose permission this work is being published.

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Continuous and Batch Treatment of Industrial Wastes*

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IN order to meet the growing demand of industry, the world's first engineering laboratory devoted exclusively to the development of electric typewriters and related electronic office equipment of advanced design was established by IBM Corp. on company acreage, across the Beltline Highway from the manufacturing facility at Lexington, Ky. Completed in July, 1957, the modern two-story structure with 42,000 sq. ft. of floor space contains the most advanced laboratory equipment available to industry. The industrial waste treatment facilities are located in the basement of the processing wing and occupy an area of approximately 6,000 square feet.

Sources and Quantity of Industrial Wastes

The average total water consumption by the plant is approximately 15,000,000 gallons per month. Some of that water is used by the following departments, in the quantities shown:

	gallons per month
Plating Department	3,000,000
Mechanical Finishing	1,500,000
Heat Treating Department (cooling coils)	3,500,000

In addition, it is estimated that 1,500,000 gallons per month are used for sanitary purposes. Most of the remainder is used in operations which do not result in the discharge of contaminated industrial wastes.

The sanitary wastes and industrial wastes are piped separately to the municipal sanitary sewers and the uncontaminated water flows to the storm sewers. Of the industrial wastes, only the effluents from the plating department, the spent solutions from the mechanical finishing department, the concentrated oil wastes and the paint wastes receive treatment prior to discharge into the municipal sewers. The running rinses from the mechanical finishing department are piped to the municipal industrial waste sewers without treatment because they contain relatively small amounts of essentially non-toxic constituents. Cooling water from the plating department is recirculated in a closed chilled water system. Other cooling water is piped to the storm sewers.

All industrial wastes piped to the industrial waste sewers pass through an underground tank made of concrete, with a capacity of 130,000 gallons, which provides a detention time of more than 8 hours under average flow conditions. The tank is provided with two 250 gallon-per-minute pumps located in a dry pit, which can be throttled to distribute the daily flow over a 24-hour period.

Contaminated wastes may originate in the following four departments:

1. Plating
2. Mechanical Finishing
3. Heat Treatment
4. Painting

PLATING DEPARTMENT:

Approximately 70 per cent of the volume of contaminated industrial wastes is discharged by the various plating lines. Three types of plating processes are used: continuous rack, continuous barrel, and still plating. The parts are processed in cadmium, copper, nickel, and chromium plating baths. The first two baths are of the alkaline cyanide type, the other two of the acid type.

In addition to the free and metallic-complex cyanides, the metal salts and chromic acid, which are used in plating solutions, such compounds as caustic soda, soda ash, mineral acids, detergents, wetting agents and proprietary compounds containing mixtures of the above ingredients, are used and are found, therefore, in the contaminated wastes reaching the industrial waste treatment plant. Alkaline compounds predominate and, on an equivalent basis, they exceed the acids by approximately 25 per cent. Not included in this estimate are cyanides and chromic acid.

The volume of rinse water consumed is relatively small because of the use of countercurrent rinsing. Because of the fact that the flow of rinsing water is relatively small in relation to the size of the rinse tanks, and is not sufficient to thoroughly mix the contents of the rinse tanks, air is used to provide additional mixing. Water sprays are used to complement immersion type rinsing, where required.

The control of water flow for rinsing purposes is effected by means of solenoid-operated valves on the fresh water lines, which are actuated by conductivity cells with the probes immersed in one of the rinses in each multiple rinsing assembly. The rinse usually selected for control is one where the change in concentration of the contaminants can be detected readily by a conductivity cell. The sensitivity of the cell is not sufficient to detect the small degree of contamination which is allowed in the final rinse, particularly

*Presented at the 14th Industrial Waste Conference, Purdue Univ., Lafayette, Ind., May 5-7, 1959.

in a rinsing system following the plating operation, since the increase in concentration of dissolved substances is relatively small by comparison to the concentration of substances dissolved in fresh water.

MECHANICAL FINISHING DEPARTMENT:

This department is primarily concerned with the chemical and mechanical surface polishing of metal parts used in the manufacture of typewriters. The parts to be finished are mixed with mildly abrasive pebbles in rotating plastic barrels which are either perforated or imperforate. The perforated barrels are moved automatically from bath to bath through a series of operations involving degreasing, rinsing, descaling, rinsing, alkaline polishing, and application of rust preventive. The solutions used in the machines contain such chemicals as wetting agents, synthetic detergents, boric acid, aluminum sulfate, sodium bisulfate, soda ash, trisodium phosphate, caustic soda, borax, china clay, aluminum oxide, and some phosphates.

As mentioned previously, the running rinses from this department do not require pretreatment prior to discharge into the municipal sewers, but the spent solutions are batch treated as it will be discussed later.

HEAT TREATING DEPARTMENT:

The only wastes from this department which cause the greatest concern, insofar as treatment, are the spent heat-treating salts containing sodium cyanide. Approximately 1500 pounds of those salts are discarded monthly, containing approximately 30 per cent sodium cyanide, some sodium carbonate, the rest being barium chloride.

The solidified salts are received in 30-gallon containers, which are perforated and immersed in water inside a steel tank provided with mechanical agitation, where the salt is allowed to dissolve. The solution is then fed gradually to the cyanide treatment system.

Other cyanide-rich wastes orginate from brine quenches which are dumped once a month, and from alkaline washes which are dumped twice a week. These are collected and treated in the cyanide treatment system.

In addition to the cyanide wastes, there are oil-rich wastes which originate either from dumpings or overflow of washing machines, or from rinse tanks following oil quenching treatment of parts which have been treated in molten salt baths containing cyanides. The oil wastes are conveyed by pumping to batch treatment tanks.

PAINTING DEPARTMENT:

This includes a continuous phosphating line, two alkaline paint stripping tanks and three spray booths. The spent solutions from the phosphating line, which contain alkaline cleaners, sulfuric acid, phosphoric acid, and chromic acid in relatively low concentrations, are discharged weekly and pretreated batchwise before final discharge into the municipal sewers. The individual discharge from the painting department do not exceed 500 gallons in capacity and, because of their relatively low volume and low concentrations of contaminants, they do not present much of a problem as regards treatment.

The contents of the two alkaline (8% sodium hydroxide) strip tanks, and the alkaline (0.72% sodium hydroxide) solutions which are continuously recirculated to the spray booths, are discharged weekly and pretreated batchwise.

Design Criteria and Requirements of Waste Treatment

Design work on the proposed industrial waste treatment facilities was initiated after plans had been prepared for the manufacturing plant and while construction of the plant was in progress. The design engineers were informed that the treatment plant would have to be located in the basement of the processing wing of the plant where an area of approximately 6,000 square feet was available and a maximum headroom of 10 feet.

Schematic drawings were furnished which showed the sequence of operations, the number and size of tanks used, the composition of the solutions used, the number of rinses to be used, the amount of dragout or carryover to be plated per rack or per barrel, the number of racks or barrels to be processed per hour, and the expected frequency of dumping of the various concentrated solutions. The amount of dragout had been determined experimentally in a previous survey of the plating department at Kingston, N. Y.

As a criterion of good rinsing, the following con-

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centrations of contaminants could be allowed in the final rinses:

Nickel salt	39	ppm.
Cyanide (CN)	39	"
Chromic acid	16	"
Proprietary alkali cleaner	780	"
Mineral acids	780	"

On the basis of the above information, water requirements for rinsing purposes were calculated from the standard equation. (See METAL FINISHING GUIDEBOOK, pp. 455-9, 1959 Ed.) To the amounts of contaminants in the rinses and the flows of those rinses were added the amounts of dissolved solids in the spent process solutions and the volumes of those solutions.

At this point, one might ask why actual data had not been collected at the Kingston plant on flow rates and compositions of the effluents and analyzed at the waste treatment plant? The answer would be that little control was exercised on the flow or rinses at Kingston and that additional plating lines were to be used at Lexington which were not similar to those in Kingston.

City ordinances prohibited the discharge of water or waste to any public swer containing more than 100 parts per million by weight of fat, oil or grease; or having a pH value lower than 5.5 or higher than 9.0. The ordinance further stipulated that the admission to the public sewers of any waste containing more than 350 parts per million by weight of suspended solids or having an average daily flow greater than 2 per cent of the average daily sewage flow of the City of Lexington, would be subject to the review and approval of the City Engineer.

Sodium cyanide content should be less than 2 ppm., based on a 25 gallons per minute flow, and the chromic acid content should be less than 5 ppm., based on a 10 gallons per minute flow, both flows being of 8 hours duration. Further checking on the matter with the State Water Pollution Control Commission indicated that it would be necessary to provide treatment facilities not only for the removal of cyanides but also of cyanates, since the latter, in the quantities to be discharged by IBM, might interfere with aquatic life in the stream where the effluent from the municipal sewage treatment plant is discharged.

Once the flows and compositions of industrial wastes had been determined and the limitations on the quality of discharges were known, the following preliminary criteria for design were adopted:

1. Total flow — 200 gallons per minute.
2. Cyanides to be oxidized to cyanates. Later provisions required that cyanates by further oxidized to carbon dioxide and nitrogen.
3. Treatment to be of the flow type.
4. Acids, alkalies, cyanides, and chromate spent process solutions to be collected in separate storage tanks. Each tank should have a capacity equal to twice the volume of the largest process tank containing the solution in question. Provisions should be made for the gradual feeding of the various spent solutions to the treatment systems.
5. Equalization tanks should be provided for the acid-alkali, cyanide, and chromate waste. They should provide a nominal retention time of 30 minutes for the acid-alkali wastes, 4 hours for the cyanide rinses and 2 hours for the chromate rinses.
6. All effluents discharged to the sewers should

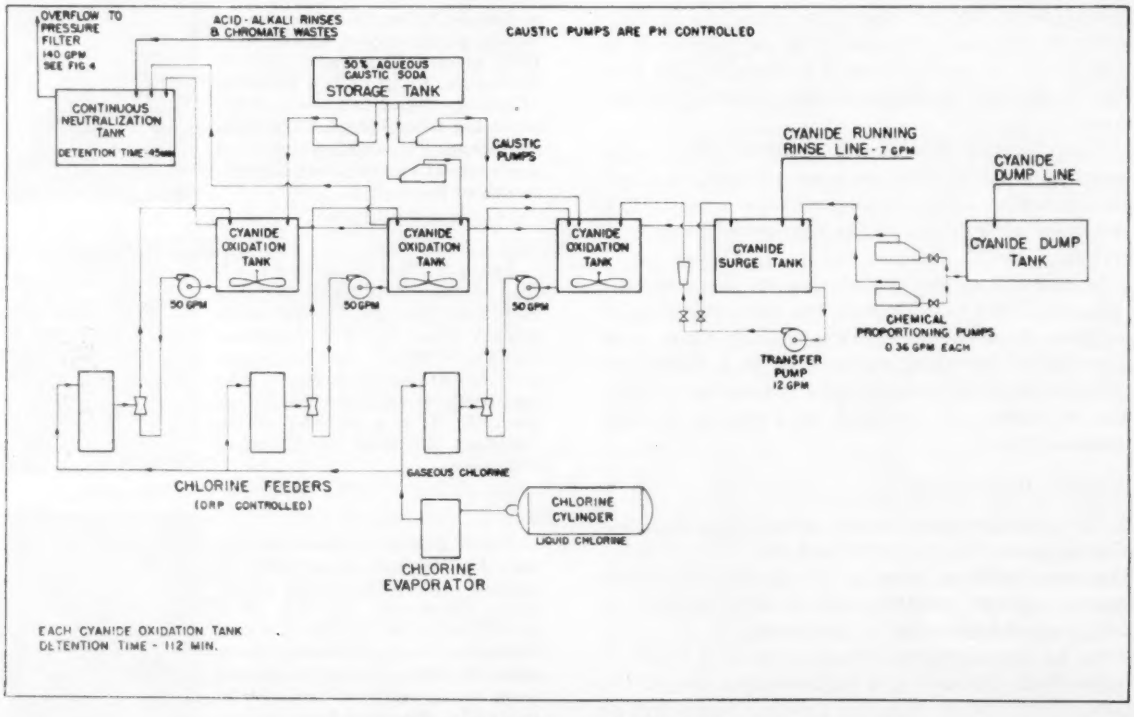

Fig. 1. Flow diagram for cyanide wastes.

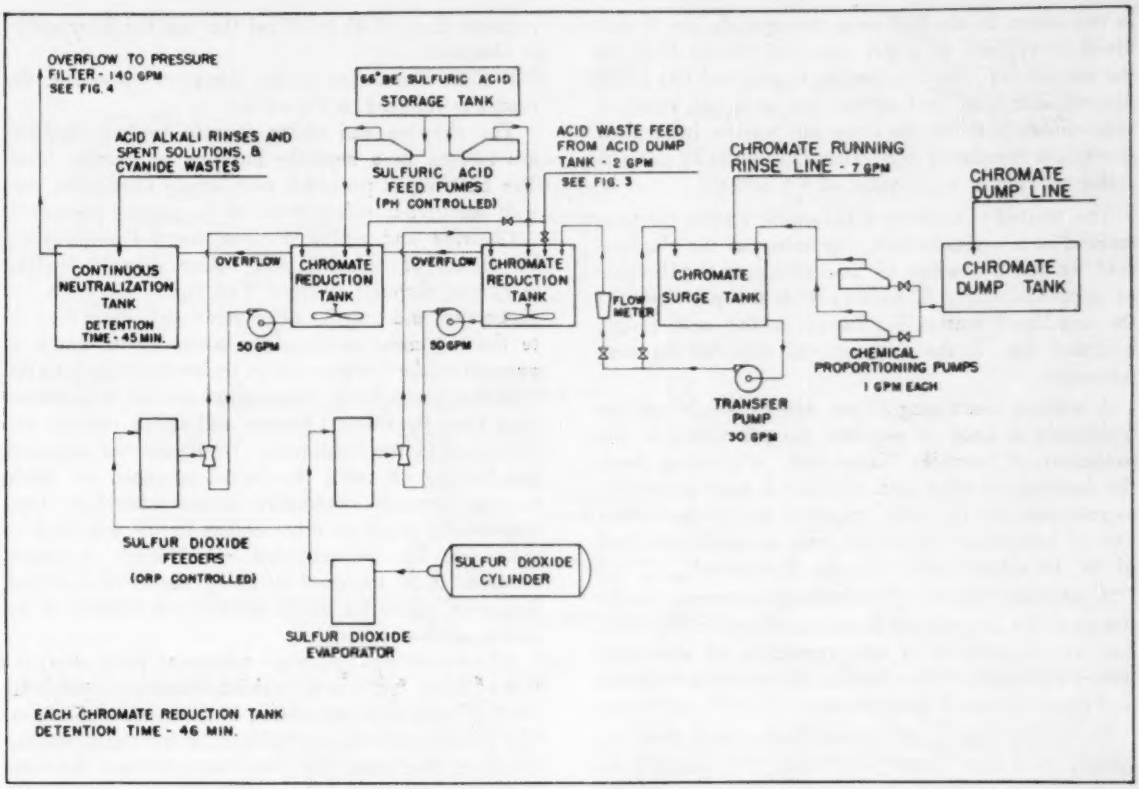
OVERFLOW TO PRESSURE FILTER - 140 GPM SEE FIG. 4
66° BE' SULFURIC ACID STORAGE TANK
ACID ALKALI RINSES AND SPENT SOLUTIONS, & CYANIDE WASTES
SULFURIC ACID FEED PUMPS (PH CONTROLLED)
ACID WASTE FEED FROM ACID DUMP TANK - 2 GPM SEE FIG. 3
CHROMATE RUNNING RINSE LINE - 7 GPM
CHROMATE DUMP LINE
CONTINUOUS NEUTRALIZATION TANK DETENTION TIME - 45 MIN.
OVERFLOW
CHROMATE REDUCTION TANK
OVERFLOW
CHROMATE REDUCTION TANK
FLOW METER
CHROMATE SURGE TANK
CHROMATE DUMP TANK
50 GPM
50 GPM
CHEMICAL PROPORTIONING PUMPS 1 GPM EACH
TRANSFER PUMP 30 GPM
SULFUR DIOXIDE FEEDERS (ORP CONTROLLED)
SULFUR DIOXIDE CYLINDER
SULFUR DIOXIDE EVAPORATOR
EACH CHROMATE REDUCTION TANK DETENTION TIME - 46 MIN.

Fig. 2. Flow diagram for chromate wastes.

contain less than 20 ppm. of total suspended solids.

All of the plating wastes are treated continuously, while the concentrated solutions from the mechanical finishing department and the painting department, as well as oil carrying wastes from the heat treating department, are treated batchwise.

The control system is the heart of any automatic treatment system and therefore must be reliable and relatively trouble free. The controls have been sectionalized with the treatment tanks, pumps and chemical feeders. Each treatment tank has all the necessary controls, pumps, and feeders to treat waste independently of the other controls. This gives 100 per cent reliability to both the cyanide system and the chrome waste system. The cyanide treatment can be accomplished in two tanks and the chrome treatment in one tank. The piping is arranged in such a way as to make this possible. When one tank is out of service for any reason, the concentration of the waste must be kept as low as possible. This is done by not pumping the concentrated dump tank. It is advisable to have all the treatment tanks in operation when the concentrated dumps are pumped into the system.

All recorder-controllers are electronic, with on or off relay control to the chemical pumps for pH control and air relay signal for chlorine and sulfur dioxide feed. The feeders each have a flow meter which telemeters a signal back to the control panel giving the rate of flow. This is important in that it tells the operating condition of the feeders from their remote location.

Continuous Treatment

The continuous treatment facilities have been designed to handle maximum flows of 200 gallons per minute and average flows of approximately 150 gallons per minute. The wastes are segregated at their sources into the following streams which are gravity sewered to the waste treatment plant:

1. Cyanide-rich rinses.
2. Chromate-rich rinses.
3. Acid and alkaline rinses.
4. Concentrated spent cyanide solutions.
5. Concentrated spent chromate solutions.
6. Concentrated spent acid solutions.
7. Concentrated spent alkaline solutions.

Three separate treatments are provided respectively for the cyanide wastes, chromate wastes, and the alkaline-acid wastes which do not contain cyanide or chromium. The concentrated dumpings, which are collected in separate tanks, are fed gradually by means of chemical proportioning pumps to the respective treatment tanks.

The rinses, which are collected in surge or equalization tanks, are fed by means of low capacity centrifugal pumps to the respective treatment tanks. The discharge pipes from the pumps are so connected that part of the flow can be recirculated to the surge tanks. Overflow pipes connecting the surge tanks to the treatment tanks have been provided to be used in case of failure or inability of the pumps to handle the flow. By the use of the pumps, it is possible to maintain an even flow to the treatment tanks.

The cyanide wastes are oxidized by gaseous chlorine

in two steps. In the first step, the cyanide ion is oxidized to cyanate at a pH value of 9.5 to 10.0. In the second step, the cyanate ion is oxidized to carbon dioxide, nitrogen, and nitrate ion at a pH value of approximately 8. In the chromate wastes, hexavalent chromium is reduced to trivalent chromium by gaseous sulfur dioxide at a pH value of 1.8 to 2.0.

The treated cyanide and chromate wastes are neutralized in a common tank, together with the alkaline-acid wastes, by means of lime slurry at a pH value of approximately 8.0. Inasmuch as the pH value of the combined wastes is always in the acid range, hydrated lime is the only reagent required for neutralization.

A solution containing 50 per cent by weight sodium hydroxide is used to regulate the pH value, in the oxidation of cyanide. Waste acid, originating from the dumping of spent acid solutions is used preferably to maintain the pH value required for proper reduction of hexavalent chromium, and an additional feed of 66° Be sulfuric acid is made, if required.

A schematic layout of the cyanide treatment facilities up to the neutralization stage is shown in Figure 1. For an illustration of the treatment of chromate wastes and acid-alkaline wastes, the reader is referred to Figures 2 and 3 respectively.

The slurry leaving the neutralization tank flows by gravity to a filter sump wherefrom it is pumped by means of two 250 gallons per minute centrifugal pumps, capable of discharging against a pressure of 60 psi, to two horizontal shell, vertical, stainless steel leaf-filters coated with a precoat of diatomaceous earth. Each filter has a net filtering area of 775 sq. ft. To assist in the filtration of the slurry, a body feed consisting of diatomaceous earth is continuously injected by means of a proportioning pump. Relatively small quantities of a coagulant aid are also added. The filtration unit is maintained in operation until a pressure drop of 45 to 50 psi through the filter leaves is obtained.

For an illustration of the filtration operation, the reader is referred to Figure 4.

The chlorine and sulfur dioxide feeding facilities are located in a separate building at ground level. The building is provided with ample ventilation and with additional safety features to protect personnel.

Chlorine and sulfur dioxide are fed respectively by means of chlorine and sulfur dioxide feeding machines, through ejectors. The liquid necessary for absorption and transfer of chlorine and sulfur dioxide to the treatment tanks is the waste itself, which is pumped to the ejectors and is recirculated back to the treatment tanks.Three chlorinators and two sulfonators have been provided. Chlorine and sulfur dioxide are furnished in ton containers. To obtain the required gas feeding capacity, the liquid reagents are made to pass through electrically heated water-bath type evaporators prior to introduction to the gas feeding machines. The consumption of chlorine or sulfur dioxide can be termined either by means of dial type scales, on which the ton containers are located, or by means of flow recorders.

All cyanide and chromate treatment tanks are provided with pH and oxidation-reduction-potential (O-R-P) electrode assemblies of the submersion type. The pH electrode assemblies include the usual calomel reference electrodes, the glass electrode and the temperature compensator. The O-R-P or redox electrode assemblies include a calomel reference electrode, a gold electrode in the chromate reaction tanks and a gold electrode in the cyanide treatment tanks. Platinum electrodes have been found to be unsatisfactory in cyanide oxidation treatment, because of the tendency of platinum to become poisoned.

A pH electrode assembly, also of the submersion type, is located in the neutralization tank. pH electrode assemblies are used for the on-and-off control of

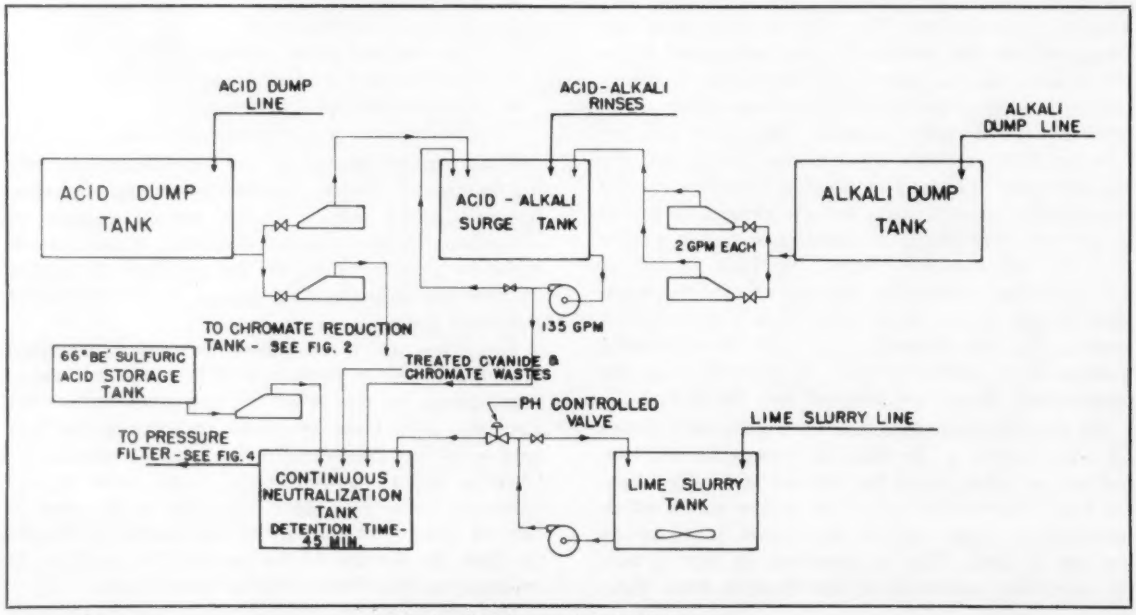
ACID DUMP LINE
ACID-ALKALI RINSES
ALKALI DUMP LINE
ACID DUMP TANK
ACID - ALKALI SURGE TANK
ALKALI DUMP TANK
2 GPM EACH
135 GPM
TO CHROMATE REDUCTION TANK - SEE FIG. 2
66°BE' SULFURIC ACID STORAGE TANK
TREATED CYANIDE & CHROMATE WASTES
PH CONTROLLED VALVE
LIME SLURRY LINE
TO PRESSURE FILTER - SEE FIG. 4
CONTINUOUS NEUTRALIZATION TANK DETENTION TIME- 45 MIN.
LIME SLURRY TANK

Fig. 3. Flow diagram for acid-alkali wastes.

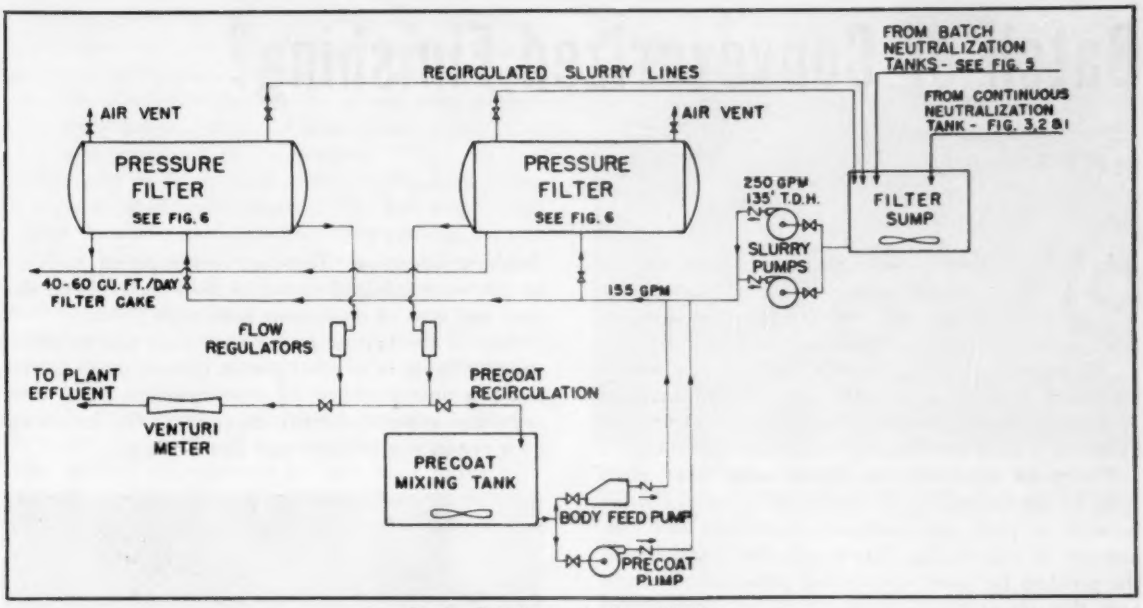

Fig. 4. Flow diagram for slurry filtration.

chemical proportioning pumps feeding caustic soda to the cyanide treatment tanks and sulfuric acid to the chromate treatment tanks, and for the proportional control of an air operated diaphragm valve on the lime slurry feed line. The O-R-P electrode assemblies also control the chlorinators or sulfonators on a proportional basis through a 3 to 15 psi air signal.

All tanks are either rectangular or square. Their maximum height, as dictated by available head room, is 8 feet. All shells for the storage and treatment tanks are constructed of steel, which is lined internally with 3/32 inch thickness of plasticized polyvinyl chloride (PVC) sheeting for the cyanide and chromate treatment tanks, the spent acid and chromate storage tank, and all surge tanks, with the exception of the concentrated cyanide waste storage tank.

The chromate and cyanide treatment tanks are provided with steel covers lined internally with plasticized PVC sheeting. The covers have been furnished to isolate the ventilation systems for those tanks from the rest of the plant.

All treatment tanks are provided with propeller type agitators, lined with material of construction resistant to chemical attack, where required. All agitators are capable of providing approximately one tank turnover per minute.

The chemical proportioning pumps for acid feeding, which are of the plunger type, are constructed of rigid unplasticized polyvinyl chloride. The chemical proportioning pumps for caustic feeding are constructed with cast iron body and Hastelloy D plunger. The centrifugal pumps which connect the chromate treatment tanks to the ejectors of the sulfur dioxide feeding machines are made of steel, lined internally with a chlorinated polyethylene elastomer, while the recirculation pumps which connect the cyanide treatment tanks to the ejectors of the chlorine feeding machines are made of cast iron. With a few exceptions, most of the piping in the waste treatment area consists of threaded schedule 80 rigid unplasticized polyvinyl chloride plastic piping.

Lime slurry, which is trucked from Louisville, Ky., is stored in an open steel tank, provide with mechanical agitation, with a capacity of approximately 5,000 gallons. The slurry is a by-product from the production of acetylene from calcium carbide and water. It contains approximately 40 per cent solids, containing approximately 95 per cent calcium hydroxide. A lime recirculation pump is used to feed the slurry to the neutralization tank and recirculate the unused portion back to the storage tank.

The pressure filters consist of horizontal steel shells 60 inches in diameter, constructed for 75 psi maximum working pressure, and 36 drainage members, rectangular in shape, consisting of support plates made of Type 304 stainless steel and with outer cloths made of 24 by 110 Dutch weave, also constructed of Type 304 stainless steel.

Sulfuric acid (66° Bé) is stored in a cylindrical vessel made of low carbon steel, with a capacity of approximately 4,400 gallons. Caustic soda, which is purchased as a 50 per cent by weight aqueous solution, is stored in two cylindrical vessels, also made of low carbon steel, each having a capacity of 6,800 gallons.

Of interest is the degree of ventilation provided in the treatment area. In addition to a complete air change every 3 minutes, separate ventilation is provided for the following tanks:

	cfm/ft.² solution surface
1. Chromate treatment tanks	19
2. Chromate surge tanks	9
3. Cyanide treatment tanks	9
4. Cyanide surge tanks	12
5. Cyanide storage tanks	7

The exhaust air from the aforementioned locations is dicharged through the respective ducts servicing the plating department.

(To be continued)

Batch or Conveyorized Finishing?

By R. F. Young

EVERY growing metal parts manufacturer reaches a point in his operation where he must decide whether to retain his batch or stationary metal finishing operation or go to a conveyorized system.

The reason is simple: at certain levels of production, stationary finishing is best and conveyorized finishing is a costly luxury. Beyond this level, a conveyorized system is a must for efficient, economical operation.

The point at which this change-over takes place must be determined by an analysis of physical characteristics of parts, application requirements and consistency of volume. But this is only the beginning of the problem for plant engineering personnel. To them falls the job of deciding what type of conveyorized system best meets their needs. To make this decision, plant engineers must be familiar with the types of equipment available, the costs involved, the special problems of their own operation, and a myriad of related problems.

At the Charles Bruning Company, Inc., a leader in the manufacture of copying equipment, production management was faced with just such a problem. Fortunately, the problem arose at the time the company was expanding its facilities with the building of a new plant in Mount Prospect, Illinois, a northwest suburb of Chicago. As sales and production had risen steadily over the preceding years, production in the finishing department was on the borderline between stationary and conveyorized finishing.

The plant move represented a real opportuniy for Works Manager J. P. Arndt, and his two colleagues, E. J. Vuksnic, Production Manager, and J. P. Jensen, Production Control Manager, to set up an efficient finishing operation. Thorough investigation and research were indulged in before final decisions on design and type of equipment were made.

One of the first steps the men took was to study existing facilities in other plants. Several plants in the midwest area provided an opportunity to study conveyorized systems, thereby acquainting the men with each system's advantages and disadvantages.

All illustrations courtesy of Binks Mfg. Co., Chicago, Ill.

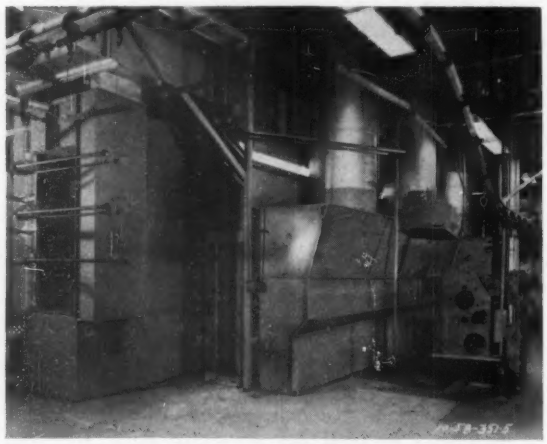

Fig. 1. Coming from the dry off oven the units travel about 60 feet allowing them plenty of time to cool off before entering the spray booth (far left).

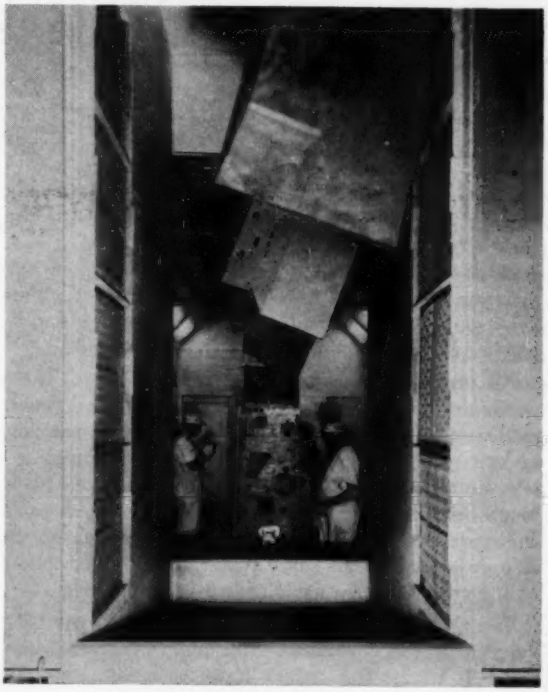

Fig. 2. View from outside the booth looking in. Filtered vestibule air diffusers handle delicate job of maintaining slightly higher air pressure within the booth to prevent entrance of dust or other foreign matter.

At a steel fabricator's plant in Wisconsin, they observed a down draft, water wash spray booth, and decided that it would be ideal for their own operation.

In another manufacturing plant, the men observed a 36-foot, three stage washer unit combining all the features needed by Bruning. After extensive surveys were made, a detailed specification was written for bidding purposes. The specifications included performance requirements. A scale model was made which was helpful in explaining the layout and the process to top management as well as bidding contractors.

One of the most important things the men learned was that it is best to have the prime contractor oversee the installation of the new equipment. Responsibility for the completed job was thus centered in one organization.

The completely conveyorized Bruning installation, in the otherwise open manufacturing plant, is located in a room of its own, measuring 110 feet long by 45 feet wide. The room contains the phosphating washer unit, spray booth, painting mixing room, paint bake oven, and equipment for air makeup.

The parts to be finished enter the finishing room through an aperture in the wall. The first step is the washer. This is an iron-phosphate type washing process designed to remove all manufacturing grease and grime from the metal and especially prepare the surfaces for paint application.

After passing through a cold water rinse, the parts enter a chromic acid rinse process. After leaving the washer, the parts make a 180-degree turn and pass through a low heat, high air velocity drying oven. They then travel 60 feet to allow them time to cool, make another 180-degree turn and go directly into the spray booth. Here two spray painters coat the parts with gray, black, or pastel enamel.

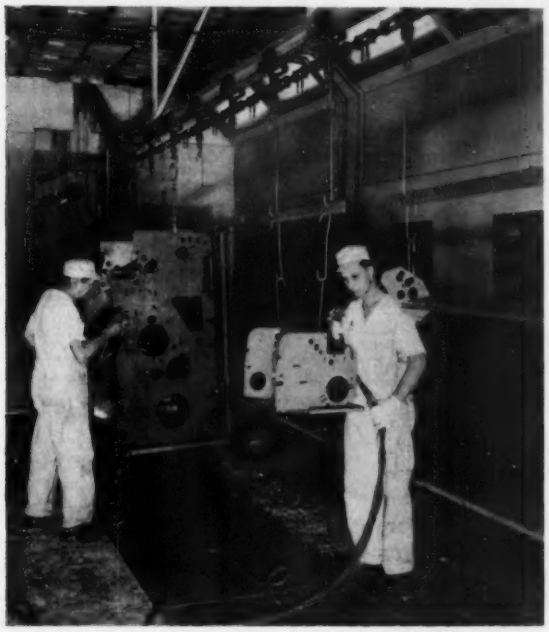

Fig. 3. Inside the booth, air is constantly circulating down from the ceiling air filters to the floor grating. Beneath the grating the moving air collects overspray and paint fumes which are removed by baffles before passing through stacks above the plant roof.

Different types of equipment receive different colors. Large machines for engineering whiteprints are finished in two color hammertone gray. Smaller desk model machines are finished in gray or pastels. Certain components are in contact with chemicals in their operation; these parts are finished with a chemical-resistant plastic paint.

"One of the more important aspects of our new finishing system," Mr. Jensen said, "is the high efficiency of our totally enclosed spray booth." Despite conveyor openings measuring approximately 4 feet wide by 12 feet high, the booth is a sealed room. This is accomplished by maintaining air pressure inside the booth slightly higher than outside air pressure.

Fig. 4. After passing through the spray booth the parts rise about 10 feet and enter the baking room. Here, a 22-minute baking cycle is completed after making three passes or loops in the oven.

The booth is 30 feet long, 12 feet high and has a 12 foot working width. The work travels above a floor grating 3½ feet wide running the length of the booth. Beneath the grating is a pit from which water is pumped through a series of baffles.

Air is drawn into the booth through a plenum chamber in the ceiling. This chamber measures 30 feet long and 8 feet wide and is equipped with 68 filter cells to remove any impurities from entering air before it can contaminate the products. This air is drawn down over and around the work into the chamber above the water in the pit. The water is pumped from the pit and flows down through the baffles. At the same time high velocity fans suck air from the booth through these baffles. The water removes the paint particles and clear air is expelled through roofstacks to the atmosphere.

At each end of the booth is a vestibule measuring 3½ feet wide and 8 feet long. It is here that the balance between air pressure inside the booth and outside pressure is maintained. Each of these vestibules is equipped with a filtered air diffuser to prevent air currents from either entering or leaving the booth entrance and exit.

On leaving the spray paint booth, the parts rise about 10 feet and enter an overhead "A" type paint bake oven. They traverse the 40 foot oven, making three passes before leaving at the other end. After leaving the oven, cooling while they travel, the parts travel to the final assembly department where they are removed for immediate use. The cycle is complete.

According to Mr. Arndt, the finishing department is not at present working at full capacity. He said the design of the installations was keyed to ultimate planned plant expansion. At present the finishing department employs five men.

In order to efficiently finish small parts for an electric erasing machine, which the Bruning Company manufactures, a single "stationary" spray booth is still maintained. It is a small open water wash spray booth manned by one spray painter applying a black enamel to the caps and cases automatically.

Science for Electroplaters

55. Cyanide Copper Analysis

By L. Serota

THE analytical procedures required for the control of a copper cyanide plating solution include determinations of copper, free sodium cyanide, carbonate. and Rochelle salt.

Copper Determination

The following method of analysis for copper content is given in METAL FINISHING GUIDEBOOK:

1. A 10 ml. sample, drawn from a burette, is run into a 250 ml Erlenmeyer flask. A 10 ml pipette may be used, provided that a safety bottle is included in the sampling device.

2. Add ½ ml concentrated nitric acid, HNO_3, to a test tube, then cautiously add 5 ml of concentrated sulfuric acid (H_2SO_4). The acid mixture is then added to the flask containing the plating solution, under a well ventilated hood. The mixture must be shaken. Operation under a hood is necessary because poisonous cyanide fumes are evolved. Boil until dense white sulfur trioxide fumes, SO_3, are evolved. If the solution contains Rochelle salts, add 10 ml of H_2SO_4 as soon as the SO_3 fumes are given off. Cool the solution, then add 2 ml. of HNO_3 and boil. The carbonaceous precipitate which would obscure the titration end-point later in the analysis is thereby decomposed.

3. Cool, add 100 ml of distilled water and warm until solution is completed.

4. Cool and add concentrated ammonium hydroxide, NH_4OH, while shaking, until the solution is colored a deep blue. Boil for 15 minutes to remove the excess ammonia.

5. Add 10 ml of a 30 per cent (by volume) acetic acid solution and a very small amount of sodium fluoride which serves to combine with any iron present. Heat, if necessary, to redissolve copper compounds. The clear solution should be light blue.

6. Cool to room temperature and add 25 ml of a 20 per cent potassium iodide solution and shake.

7. Titrate immediately with standard sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$, solution (standardized as directed below) until the brown color begins to turn yellow.

8. Add 2 ml of a 1 per cent starch solution (prepared by making a paste of 1 gram of starch with cold water, then add to 100 ml of boiling water, cool and decant). Continue the titration until the blue color, which formed when the starch indicator was added, disappears for about 1 minute.

The standard thiosulfate solution is prepared as follows: Dissolve 25 grams of $Na_2S_2O_3 \cdot 5H_2O$ in 1 liter of water. Weigh, accurately, 0.20 gram of pure copper wire or turnings, transfer to a 250 ml Erlenmeyer flask and dissolve with about 10 ml of 1:1 nitric acid, HNO_3. Add 5 ml of concentrated sulfuric acid, H_2SO_4, and heat until dense white sulfur trioxide, SO_3, fumes are evolved. Cool, add 100 ml of water and repeat the procedure as indicated above in steps 4 through 8. Sodium thiosulfate must be standardized because certain micro organisms, which may be present in water, are capable of decomposing some of the thiosulfate into sodium sulfate and water.

CALCULATIONS:

The metallic copper, Cu, in oz./gal. equals: ml thiosulfate required for sample $\times \left\{ \frac{2.67}{\text{ml thiosulfate required for 0.20 g. copper}} \right\}$

The factor 2.67 is derived as follows:

Standardization: ml $\times$ N $\times$ me = wt.

or, $N = \frac{0.2}{\text{ml} \times 0.06354} = \frac{3.14}{\text{ml thiosulfate required for 0.2g Cu.}}$

Titration: ml $\times$ N $\times$ me = wt of Cu in 10 ml sample or, ml $\times$ N $\times$ 0.06354 $\times \frac{1000}{10} \times 0.134$ = wt Cu in oz/gal.

Substitution: ml $\times \left\{ \frac{3.14}{\text{ml thiosulfate required for 0.2g Cu}} \right\} \times 0.06354 \times \frac{1000}{10} \times 0.134$ = wt Cu oz/gal

or ml thiosulfate required for sample $\times \left\{ \frac{2.67}{\text{ml thiosulfate required for 0.2g Cu}} \right\}$ = Cu oz/gal.

The principal reaction in this titration entails the reduction of the curpic ion, Cu^{++}, (as in cupric acetate) to the cuprous ion, Cu^{+}, by the iodide ion, I^{-}, with the formation of cuprous iodide, a white precipitate, and free iodine: $2Cu^{++} + 4I^{-} \rightarrow Cu_2I_2 + I_2$ or, $2Cu(C_2H_3O_2)_2 + 4KI \rightarrow Cu_2I_2 + I_2 + 4KC_2H_3O_2$. The liberated iodine is subsequently titrated with sodium thiosulfate with starch as indicator. This method of titration is known as iodimetry. Sodium iodide and sodium tetrathionate ($Na_2S_4O_6$) are the products of this reaction: $I_2 + Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6$. Copper is determined quantitatively by this titration.

Complexometric Determination of Copper

In addition to the iodimetric and electrolytic methods of determining the copper content in copper cyanide — Rochelle salt plating baths, the complexometric determination of copper, using disodium dihydrogen ethylenediaminetetraacetate dihydrate (EDTA) as the complexing agent (Fig. 216), with murexide as

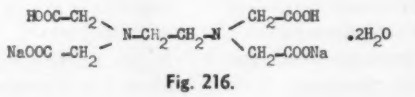

Fig. 216.

the indicator, has been suggested by C. K. Gehrand as a satisfactory method.

The following procedure for the copper determination is recommended by the author.

1. A 10 ml sample of the copper cyanide-Rochelle salt plating solution is diluted to the mark in a 100 ml volumetric flask.

2. 10 ml of this diluted solution is then drawn and placed in a 250 ml beaker (note that this 10 ml represents only 1 ml of the plating solution).

3. The solution is heated (under a hood) and hydrochloric acid added until a clear solution is obtained. The solution is then evaporated to dryness and cooled. Nitric acid is added slowly, in small quantities, with evaporation to near dryness and cooling occurring between each addition.

4. The salts are dissolved by adding about 50 ml of water while stirring.

5. The prepared buffer solution is added dropwise until a blue color appears. A few drops are then added in excess. If any iron is precipitated, it may be filtered.

6. The solution is now transferred to a 500 ml Erlenmeyer flask and diluted to 250 ml with distilled water.

7. Add 2 to 3 mg. of the indicator powder, murexide, and stir until it is dissolved. A yellow to yellow brown color should result.

8. Titrate with 0.05 molar (0.1N) EDTA solution until the yellow or yellow-brown color changes to an orange-red and then to a permanent purple-red color.

9. Ml 0.05 molar EDTA solution $\times$ 0.4260 = copper, oz/gal.

CALCULATIONS:

Mol. wt. EDTA ..... 372.032 g.
Equivalent weight ..... 186.016 "
0.05 M ..... 18.60 "
0.1N ..... 18.60 "

1 ml 0.05 molar =
$1 \times .1 \times .03179 =$
0.003179 grams Cu

ml (EDTA) $\times$ 0.003179 $\times$ 1000 $\times$ 0.134 = copper, oz/gal or, ml (EDTA) $\times$ 0.4260 = copper, oz/gal.

REAGENTS:

1. EDTA, 0.05 molar (0.1N) is prepared by dissolving 18.61 grams disodium dihydrogen ethylenediaminetetraacetate dihydrate in distilled water, and making up to exactly 1 liter in a volumetric flask.

2. Buffer solution is prepared by dissolving 268 grams ammonium chloride and 176 ml concentrated ammonium hydroxide in 500 ml distilled water.

3. Murexide indicator powder.

4. Hydrochloric acid and nitric acid.

Gehrand obtained the following results for copper analysis by this (EDTA) method using both a prepared copper-cyanide Rochelle salt solution containing a known amount of copper, 4 oz/gal, and a production plating solution. For the prepared solution the results for copper found in three determinations were 3.947; 4.032; 3.989 oz/gal respectively. For the production plating solution results for copper were 5.645; 5.602 and 5.559 oz/gal compared to a value of 5.525 oz/gal obtained by the iodometric method.

F. W. Gutman, who reported similar results for the complexometric (EDTA) method of analysis for copper from a cyanide solution, finds that this method is simple and faster than the thiosulfate (iodometric) method with the added advantage that this method is more accurate, since the color change in the thiosulfate titration, Gutman contends, is not abrupt. Here, too, results with EDTA were slightly higher than those obtained iodometrically. The following comparative results were recorded. The EDTA solution was standardized against 0.1 pure copper:

EDTA method	*Thiosulfate method*
5.26 oz/gal	5.23 oz/gal
5.03 "	5.02 "
3.16 "	3.15 "

Free Cyanide

1. A 10 ml sample of the plating solution, cooled to room temperature and measured by a sampling burette, is run into a 250 ml Erlenmeyer flask.

2. Add 100 ml of distilled water and 5 ml of a 10 per cent potassium iodide (KI) solution.

3. Titrate with standard 0.1N silver nitrate, $AgNO_3$, solution until a faint yellowish turbidity persists. The standard silver nitrate solution is prepared by weighing exactly 17.00 grams of the pure salt and made up with distilled water to 1 liter in a volumetric flask.

CALCULATIONS:

1 ml 0.1N $AgNO_3$ is equivalent to 0.0098 g NaCN

$$\text{ml } AgNO_3 \times N = \frac{\text{wt}}{\text{me}}$$

ml $AgNO_3 \times 0.1 \times 0.098 \times 100 \times 0.134$ = NaCN, oz/gal.

ml 0.1N $AgNO_3 \times 0.1313$ = NaCN, oz/gal.

Carbonates

1. A measured 10 ml sample of the plating solution is run into a 250 ml beaker and 100 ml of distilled water added.

2. Add, while stirring, 10 per cent barium nitrate, $Ba(NO_3)_2$, solution until no more precipitate of barium carbonate forms. Filter. Add a few drops of barium nitrate solution to the first portion of the filtrate to determine whether precipitation is complete. Wash with hot water.

3. Transfer the filter paper and the precipitate to the beaker in which the precipitation was made.

4. Add 50 ml distilled water and a few drops of a 0.2 per cent methyl orange solution (indicator).

5. Titrate with an approximately 1.0N hydrochloric acid solution until a permanent pink color is obtained.

The HCl is prepared by diluting 83 ml of C.P. acid with distilled water to 1 liter, and standardizing the acid as follows: A 5 ml sample of the prepared acid solution is pipetted into a 250 ml Erlenmeyer flask and 50 ml of distilled water added. A 2 per cent sodium hydroxide (NaOH) solution is then added dropwise until the solution is neutral to litmus. At this stage 1 ml of a 2 per cent sodium chromate, Na_2CrO_4, solution is added. The solution is then titrated with 0.1N silver nitrate. The formation of a red precipitate indicates the end-point.

CALCULATIONS:

(a) The normality of the HCl = $\frac{\text{ml 0.1N } AgNO_3}{50}$. The value 50 is obtained as follows: Ml $\times$ N ($AgNO_3$) = ml $\times$ N (HCl); or, ml $\times$ 0.1 = 5 $\times$ N; or, ml ($AgNO_3$) = $\frac{5}{0.1} \times N =$ 50 N; hence, $\frac{\text{ml 0.1N } AgNO_3}{50} = N$ (HCl).

For example, if a titration required

46.5 ml of 0.1N $AgNO_3$, the normality of the acid would be $\frac{46.5}{50} = 0.93N$.

(b) The use of 83 ml of hydrochloric acid for 1 liter of approximately 1.0N HCl is determined as follows:

$\frac{ml \times N \times me}{\% \text{ acid} \times \text{sp.gr.}} = ml\ HCl\ required;$

or $\frac{1000 \times 1 \times 0.03646}{0.37 \times 1.19} = 83$ ml (approx.) HCl.

(c) Since 1 ml of 1.0N HCl is equivalent to 0.053 gram (me) Na_2CO_3, then $ml \times N \times \frac{1000}{10} \times 0.134 =$ Na_2CO_3, oz/gal; or ml (HCl) $\times$ N $\times$ 0.0530 $\times$ 100 $\times$ 0.134; or, ml HCl (0.71 $\times$ normality of HCl) = Na_2CO_3, oz/gal.

pH Control

Control of pH in a Rochelle-copper cyanide plating solution must be confined to close limits, according to A. K. Graham, if uniform results are to be obtained. The pH can be raised readily by small additions of sodium hydroxide, NaOH. An excess should be avoided, since this would require the addition of an acid to neutralize the excess NaOH (lowering the pH) with the possible danger of liberating hydrocyanic acid, HCN. A convenient method of avoiding this complication (adding excess NaOH), a method suggested by Graham in PLATING AND FINISHING GUIDEBOOK, is the use of the buffer curve, Fig. 217, for estimating the amount of sodium hydroxide required to raise the pH. Should it become necessary to lower the pH, by the addition of acid, a diluted sulfuric acid is recommended, prepared by adding one part of the concentrated acid to two parts of water, with the added precaution of allowing the acid to flow through a tube immersed well below the surface of the vigorously stirred plating solution.

Rochelle Salt

One of the difficulties attendant upon Rochelle salt (tartrate) analysis, L. Weisberg writes in *Metal Finishing*, N. Y., was the absence of a quick and reliable method for determining tartrates. The author suggests, as a rapid, accurate method, the titration of the tartrate with a standard solution of potassium permanganate, $KMnO_4$ following the removal of copper and decomposition of cyanide. Titration of the tartrate solution with standard acid or alkali, it is indicated, may not be reliable because of the possible buffer interference.

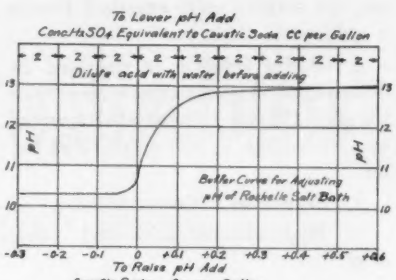
To Lower pH Add
Conc. H2SO4 Equivalent to Caustic Soda CC per Gallon
Dilute acid with water before adding
pH
Buffer Curve for Adjusting pH of Rochelle Salt Bath
To Raise pH Add
Caustic Soda - Oz. per Gallon
Approximately 30 CC = 1 Fl. oz.

Fig. 217. Buffer curve to estimate the amount of caustic soda required to raise the pH.

The Weisberg method, W. B. Stoddard, Jr., notes also in *Metal Industry*, though more rapid than previously recommended schemes, is time consuming, requires careful watching and entails good ventilation. Oxidation of the tartrates (yielding carbon dioxide and formic acid) with standard potassium permanganate, under proper conditions, yields quantitative results, Stoddard claims. This procedure for the determination of tartrates in copper cyanide plating solutions, which is generally accepted now, is rapid, since filtration is obviated, and gives reproducible results with an accuracy of one-half of one per cent.

1. A measured 5 ml sample of the plating solution is run into a 250 ml volumetric flask.

2. Add 100 ml distilled water, a pinch of phenolphthalein powder and exactly 5 ml nitrobenzene.

3. Add a 1 per cent sulfuric acid solution dropwise until the pink color just disappears.

4. Add drop by drop, while shaking, a 10 per cent silver nitrate, $AgNO_3$, solution. The end point for the addition of silver nitrate is indicated when the color of the precipitate changes from white to blue-grey. This step (adding silver nitrate) serves to remove all of the materials which ordinarily interfere with subsequent steps.

5. Shake the flask for ½ minute or until the precipitate is coagulated by the nitrobenzene. Add a drop of silver nitrate to the clear supernatant liquid to make sure that an excess is present and precipitation of the metal and cyanide is complete.

6. Add sufficient distilled water so that the solution will be at the 250 ml mark, then add exactly 5 ml of distilled water. This additional water is added to make up for the 5 ml nitrobenzene which was added earlier and does not dissolve in the water. Shake thoroughly.

7. Allow the mixture to stand until the nitrobenzene precipitate has settled in the flask as a dark colored mass.

8. To a 50 ml aliquot sample, add 5 ml 20 per cent sulfuric acid, 5 grams manganese sulfate, $MnSO_4 \cdot 4H_2O$, and 100 ml distilled water. Heat to about 160°F., then add slowly, while agitating, exactly 20 ml 0.1N potassium permanganate, $KMnO_4$, solution.

9. Allow the hot sample to stand for 5 minutes and then cool to room temperature.

10. Add 2 grams solid potassium iodide, KI, 2 ml of 1 per cent starch solution (indicator) and shake for a few minutes.

11. Titrate with 0.1N sodium thiosulfate, $Na_2S_2O_3 5H_2O$, solution until the blue color disappears for about 1 minute.

CALCULATIONS:

(a) The normality of the standard thiosulfate solution is determined as follows:

ml $\times$ N (thiosulfate) $\times$ me(Cu) = wt Cu; or, ml $\times$ N $\times$ 0.06352 = 0.2

g or $N = \frac{0.2}{\text{ml thiosulfate} \times 0.06352}$ or

$N = \frac{3.15}{\text{ml thiosulfate required for 0.2 g Cu}}$

(b) The normality of the $KMnO_4$ equals

ml $\times$ N ($KMnO_4$) = ml $\times$ N (thiosulfate); or, 10 $\times$ N = ml $\times$ N;

or, N ($KMnO_4$) = $\frac{\text{ml (thiosulfate required} \times \text{normality of the thiosulfate)}}{10}$

(c) The concentration of Rochelle salt, $KNaC_4H_4O_6 \cdot 4H_2O$, in oz/gal = ml $\times$ N ($KMnO_4$) $\times$ me (Rochelle salt) = wt of Rochelle salt; or, ml $\times$ N ($KMnO_4$) $\times$ 0.047 $\times$ 1000 $\times$ 0.134 = Rochelle salt, oz/gal; or, 6.28 (20 $\times$ normality $KMnO_4$ — ml thiosulfate $\times$ normality of thiosulfate) = Rochelle salt, oz/gal.

SHOP PROBLEMS

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METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Bismuth-Lead Bath

Question: My employer has asked me to apply an alloy deposit of about 80% lead and 20% bismuth for experimental purposes and I have been unable to find any formulas in the METAL FINISHING GUIDEBOOK or in plating texts. Do you have a suitable formula, which I can make up on a small scale?

D. R.

Answer: The only bath in our files appears to be the perchlorate type, suggested in 1921 by Fink & Eldridge. The solution consists of the following:

Metallic lead	9	g/l
Metallic bismuth	2	"
Perchloric acid	93	"
Oil of cloves	5	drops/l

Operating conditions are 40°C. and a current density of 1.2-3.6 amp./sq. ft. Increasing the current density results in an increase in the lead content of the deposit. Various ratios of lead to bismuth are obtainable by varying the proportions of the metals in the bath, which is prepared by dissolving the metal oxides in the perchloric acid with heat, followed by dilution with water.

Perchloric acid should be handled with care since, in contact with organic matter, explosions may occur.

Copper-Silver Alloy Baths

Question: Currently, we are considering plating sterling silver on stainless steel, but have been unable to find any references on this subject. Do you know of any such references that we might be able to obtain?

L. F.

Answer: Our files show no references to any bath for deposition of sterling silver or any other copper-silver alloys.

However, alloys of copper, platinum, and silver were deposited experimentally from bromide and iodide baths by Graham, Heiman and Pinkerton, ranging from 64 to 92% silver. The paper was published in Plating magazine (Vol. 36, pp. 148-53. 1949) and photostats can be obtained from the New York Public Library or the Library of Congress.

Tarnish Prevention

Question: On page 81 of the October 1959 issue of METAL FINISHING you referred to a beryllium oxide process for prevention of tarnish on silver. We would like further information in regard to this process.

Is there any danger in the handling of this solution? Can it be plated on small parts in a basket? Would it have any effect on the color — for instance, would it have a tendency to darken it?

A. M.

Answer: Beryllium and beryllium compounds are very toxic and must be handled with extreme caution. The tarnish prevention process using a film of beryllium oxide must not be used for silver tableware for this reason, and also because cleaning will remove the film.

The film is colorless and does not affect the appearance of the silver article but we do not know whether it can be applied to small parts in a basket or in a barrel.

Chromium Plating Cast Iron

Question: As a subscriber of METAL FINISHING for several years, I want to ask you about a problem I have. The problem is that I have to hard chrome a cylinder 72" long and 16" in diameter, and it is made of Chill iron. I don't know what this metal is and I don't know whether I have to etch the cylinder before plating like we do on cold rolled and carbon steel, or is the procedure like that done on cast iron?

Another problem is that the surface to be plated is about 1800 sq. in. and I just have a thousand ampere generator. Do you think that if I put this cylinder in rotation, immersed part way just to cover the cylinder alongside, could I do it that way? Because that way I have a working surface of about 300 sq. in. and I can apply 3 amperes per sq. in.

G. J. F.

Answer: Chilled iron is cast iron produced in a "chill", which causes the casting to cool at a more uniform rate. It is prepared for chromium plating in the same manner as cast iron, and procedures will be found on page 235 of the 1959 edition of the METAL FINISHING GUIDEBOOK.

If you rotate the cylinder with 300-500 sq. in. of the surface immersed below the chromium solution level, there will be no trouble plating with a 1,000 ampere generator. This practice is not unusual.

Silver Brighteners

Question: For brightening silver, we have been using sodium thiosulfate. I wonder if they are still using carbon disulfide in any of the plating firms. Please let me know, if possble, which is better.

A. W. M.

Answer: Carbon disulfide is still employed as a silver brightener, but has been superseded generally by ammonium thiosulfate, not by the sodium salt. The advantage of thiosulfate as a brightener is that an excess usually is not harmful, and the concentration is constant. In addition, its life in the bath is longer because it does not volatilize as does carbon disulfide. For bright, high-speed plating, proprietary materials are available which produce superior deposits.

Etching Resist Removal

Question: We are masking brass nameplates with asphaltum compound, then etching them in ferric chloride solution, then spraying them with enamel or lacquer, then giving them a short

dip in trichlorethylene. Although the trichlorethylene removes the asphaltum compound as required, it also softens the paints and lacquers we want to remain. Could you recommend a cycle which would accomplish a good adherent organic coating even though our asphaltum masking material is successfully removed?

S. J. S.

Answer: Since trichlorethylene has high solvency power, most enamels and lacquers will be affected adversely when placed in contact with the material. We therefore suggest you consider using a solvent which is not so potent, such as solvent naphtha, toluene, or xylene.

If you still find that your paint does not adhere sufficiently to the brass substrate, we suggest you roughen the brass to be painted, either by mechanical methods, e.g., sandblasting or steel grit blasting, or by chemical etchants which produce a surface conducive to good organic coating adhesion.

Zincating Bath for Magnesium

Question: What is the procedure in dissolving sodium pyrophosphate when making up a solution for zincating magnesium? It seems that one of our platers couldn't get it to dissolve.

A. W. M.

Answer: Sodium pyrophosphate is quite soluble in water although, if large crystals are used, they should be added to warm water for more rapid dissolving. Hot water should be avoided to prevent decomposition.

Reference on Wash Primers

Question: In the November 1959 issue of METAL FINISHING your article entitled "Keeping Pace with Progress" interested me. Would you please direct us where we may obtain more information on wash primers of the single pack and two-pack type.

J.F. F.

Answer: A comprehensive article was published recently by M. Kronstein, in Corrosion, vol. 15, p. 508T (1959), discussing all types of wash primers. Photostats can be obtained from the New York Public Library at a nominal charge, or reprints may be available from the National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Texas.

A number of patents have been granted on improvements in these primers, and abstracts will be found in past issues of METAL FINISHING.

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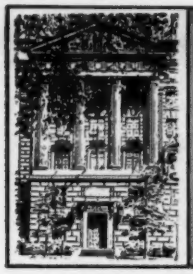

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Spray Painting Machine

U. S. Patent 2,888,903. *June* 2, 1959. *E. L. Faber, assignor to Conforming Matrix Corp.*

A spray painting machine for painting portions of objects having non-planar surfaces.

Hot Spraying

U. S. Patent 2,889,237. *June* 2, 1959. *H. A. Ball, assignor to The Cleanola Co.*

The method of applying to an object a thin permanent coating film by encircling the said object with a plurality of inclined radial nozzles directed relatively inward and disposed in circumferential spaced relation to the said object, supplying to the said nozzles a coating composition under mechanical pressure and heated to a condition of reduced viscosity.

Hot Dip Aluminum

U. S. Patent 2,890,134. *June* 9, 1959. *H. E. Linden and D. W. Mitchell, assignors to American Mollerizing Corp.*

A process for the continuous coating of continuous metallic base materials with a molten coating aluminum metal which comprises steps of: immersing the base material to be aluminized in a first pretreating molten salt bath maintained at a temperature substantially above the melting point of the molten coating metal; passing said material through an interconnecting passage into a second intermediate temperatured pretreating salt bath maintained at a temperature intermediate said first salt bath temperature and the melting point temperature of said coating metal; passing said material from the second bath into a third salt bath maintained at a temperature just sufficient to maintain said coating metal, overlying and in direct contact therewith, in a molten state; and withdrawing said pretreated material through said lower-temperatured salt bath, and into and through, said overlying coating metal to be thereby coated.

Treated Buff

U. S. Patent 2,890,136. *June* 9, 1959. *J. L. B. Vaughan, T. W. Hislop and D. H. Hanna, assignors to Canadian Hanson and Van Winkle Co., Ltd.*

A method for improving the wear resistance of a sisal buff which comprises impregnating said buff with an aqueous emulsion containing, in percentage by weight of the emulsion, about 40.0% of a solid petroleum resin, about 10.0% of a liquid petroleum resin and about 5.0% of a non-ionic emulsifier, and thereafter heating the impregnated buff to a temperature of from 70°F. to about 300°F.

Treated Buff

U. S. Patent 2,890,137. *June* 9, 1959. *J. L. B. Vaughan, T. W. Hislop and D. H. Hanna, assignors to Canadian Hanson and Van Winkle Co., Ltd.*

A method for improving the wear resistance of a sisal buff which comprises impregnating said buff with an aqueous emulsion containing, in percentage by weight of the emulsion, about 27.0% of heavy bodied soya bean oil and about 0.8% of an emulsifying agent, and thereafter heating the impregnated buff to a temperature of from 70°F. to about 300°F.

Vacuum Metalizing

U. S. Patent 2,890,135. *June* 9, 1959. *G. W. Jenkins, assignor to Anadite, Inc.*

The method of coating high tensile strength steel parts having tensile strengths in excess of 180K p.s.i., comprising enclosing the steel part to be coated in a vacuum zone, applying a vacuum in said zone of the order of 0.5 micron, vaporizing cadmium metal as a protective corrosion-resistant metal in said zone, condensing the resulting cadmium metal vapor directly on said steel part to provide a substantially uniform coating of from 0.0003" to 0.0005" on said part, and effecting the vaporization of the cadmium metal and the direct coating of the steel part in the vacuum zone under temperature and other conditions which leave the tensile strength of the cadmium coated steel part unchanged, thereby producing a high strength steel part with an adherent protective cadmium metal coating and which is free of hydrogen embrittlement.

Electroforming Rack

U. S. Patent 2,890,160. *June* 9, 1959. *B. J. Hunting, A. Rinzema, and H. Overeem, assignors to North American Philips Co., Inc.*

A device suspending phonograph record blanks in an electrolytic solution whereby one surface of the record blank not to be coated is shielded from said electrolytic solution in a liquid tight manner.

Electrostatic Spray Charger

U. S. Patent 2,890,388. *June* 9, 1959. *F. A. Croskey and C. D. Tuttle, assignors to General Motors Corp.*

Apparatus for charging a liquid spray including a spray nozzle having a spray cap issuing liquid spray therefrom, an ionizing electrode and a collector electrode spaced from said ionizing electrode, both of said electrodes being spaced from said spray nozzle in the region of the advancing spray therefrom, and a high potential power supply maintaining said ionizing electrode at a potential different from that of said collector electrode and said spray nozzle, said spray cap being composed of electrically non-conducting material, said ionizing electrode comprising an array of attenuated needles disposed in a plane transverse to the direction of the spray from said spray nozzle but out of the path thereof, all the needles which form said ionizing electrode being arranged as the ribs of a fan.

Automatic Spray Painting Machine

U. S. Patent 2,890,678. *June* 16, 1959. *R. B. Way and C. D. Hersey*

An automatic painting machine comprising a mandrel supported for rotation on said machine and a paint gun supported on said machine adjacent said mandrel.

Passivation of Stainless Steel Alloys

U. S. Patent 2,890,974. *June* 16, 1959. *C. E. Carrigan, assignor to Fairchild Engine and Airplane Corp.*

A method of passivating a stainless steel alloy which comprises immersing the alloy in a pickling solution, rinsing, heating the alloy at a temperature of from about 700°F. to about 800°F. in an oxidizing atmosphere, cooling the alloy and reacting the alloy with hydrogen peroxide until all reaction ceases.

Electrical Plating Tank Connector

U. S. Patent 2,890,991. *June* 16, 1959. *W. D. MacLean, assignor to Florida Canada Corp.*

A connector for a plating tank comprising, in combination, a tank wall, a work piece rack, and an electrical current conducting cup mounted upon said tank wall, an electrical current conducting solution within said cup, said cup having downwardly and inwardly sloping walls terminating about a limited flat supporting area at the bottom of said cup, and a bracket on said rack comprising an upright leg and a horizontal ledge on said leg extending outwardly from one end of said rack, and a current conducting rod depending from said ledge in spaced relation to said leg and extending downwardly into said cup for bodily support by said cup per se.

Separating Screen

U. S. Patent 2,891,503. *June* 23, 1959. *C. H. Ineson, assignor to The Waterbury Plating Co.*

A machine for loosening enamelled articles on screens.

Stripping Metals from Copper

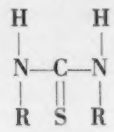
U. S. Patent 2,891,848. *June* 23, 1959. *A. L. Jaffe*

The method of removing coatings of relatively low melting-point metals from a copper article comprising immersing said article in a fused bath of sodium hydroxide and at least 1.00% but not more than about 20.00% sodium hydride.

Immersion Tin Bath

U. S. Patent 2,891,871. *June* 23, 1959. *M. Ceresa and J. R. Drobne, assignors to Westinghouse Electric Corp.*

A solid composition adapted for mixing with water to provide a solution in which tin may be immersion plated onto copper and copper base alloys consisting essentially of from 7.7% to 98.5% by weight of a water soluble compound of the general formula



from 0.2% to 64.5% by weight of at least one water-soluble stannous salt selected from the group consisting of stannous chloride, stannous bromide, stannous iodide, and stannous sulfate, and from 0.9% to 90.5% by weight of at least one normally solid water-soluble non-mineral acid selected from the group consisting of citric acid, tartaric acid, sulfamic acid, malic acid, maleic acid, and levulinic acid.

Phosphate Conversion Coating

U. S. Patent 2,891,884. *June* 23, 1959. *W. Rausch and W. Werner, assignors to Parker Rust Proof Co.*

An aqueous acidic solution for forming a corrosion-resistant coatng on a metallic surface which comprises an alkali metal nitrite in an amount in the range of about 0.1 gram/liter, expressed as sodium nitrite, an alkali metal pyro-P_2O_5 content in the range of about 0.6 gram/liter to about 8 gram/liter, said solution having a pH in the range of about 2.7 to about 3.7.

Bright Copper Plating

U. S. Patent 2,891,896. *June* 23, 1959. *F. I. Nobel and B. D. Ostrow*

A method of operating alkaline cyanide copper and brass plating baths which comprises adding to such a bath during the plating operation a soluble compound containing a radical taken from the class consisting of NO_3, NO_2, and NO, and electroplating articles therewith without intermediate filtration of insoluble matter, the ratio of copper to said radical being 0.1-30 to 1, said soluble compound being added in sufficient amount to cause the bright plating range of said bath to be substantially increased.

Electroplating Apparatus

U. S. Patent 2,891,898. *June* 23, 1959. *W. D. MacLean, assignor to General Development Corp.*

In an electroplating apparatus, a tank, a rack to carry a plurality of

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work pieces in said tank comprising a rigid structure having an overhead carrier frame, depending frame ends to suspend work pieces therebetween, and hanger for said frame ends having opposite outward overhanging ends supported upon opposite rim portions of said tank.

Portable Automatic Painting Machine

U. S. Patent 2,892,439. *June* 30, 1959. *G. Dynia*

An automatic painting machine comprising a wheeled support, self-propulsion means, painting head support means, a painting head means to feed paint to the painting head, and means on the painting head for reversing the direction of movement of the head on engagement of the direction-reversing means against an obstruction disposed in the path of the painting head.

Oxide Removal from Aluminum

U. S. Patent 2,892,738. *June* 30, 1959. *E. H. Dobratz, assignor to Koppers Co., Inc.*

A process for the removal of the oxide film from aluminum which has not been protected from oxidation and has become inactive to activate said aluminum, which process comprises contacting with hydrogen, aluminum which is suspended in a liquid medium selected from the group consisting of aluminum alkyls and alkyl aluminum hydrides and having therein a promoter selected from the group consisting of alkali metals and alkaline compounds of alkali metals.

Brighteners

U. S. Patent 2,892,760. *June* 30, 1959. *W. Gundel, W. Strauss and H. Haas, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

An electroplating bath for producing deposits of metals selected from the group consisting of nickel, copper, zinc, silver, bronze, brass, and cadmium comprising an acid solution of an inorganic salt of the metal to be deposited and a compound having the general formula

Z—S—R—Q

wherein Z is an organic radical which includes a carbon atom bonded exclusvely with three hetero atoms, one of which is the sulfur atom through which said organic radical Z is linked to the radical R—Q, the other two hetero atoms of said Z radical being selected from the group consisting of nitrogen, sulfur, and oxygen atoms, R is a bivalent aliphatic radical, and Q is a water solubilizing radical selected from the group consisting of sulfuric acid ester, phosphoric acid ester, phosphonic acid, phosphinic acid, polyether and polyalcohol radicals.

Non-Embrittling Cadmium Bath

U. S. Patent 2,892,761. *June* 30, 1959. *W. F. Hamilton and E. Simon, assignors to Lockheed Aircraft Corp.*

A non-embrittling alkaline cadmioyanide electroplating solution having a cadmium metal content of from 8% to 15% on a weight per unit volume basis and characterized by the inclusion therein of about 1 to 6.5% of a nitrate expressed in terms of sodium nitrate on a weight per unit volume basis and about .1 to 5% on a weight per unit volume basis of a water soluble aliphatic amine containing from 3 to 8 carbon atoms as a throwing power additive.

Rust Preventive Composition

U. S. Patent 2,893,880. *July* 7, 1959. *E. A. Dieman and A. T. Swanson, assignors to Standard Oil Co.*

A rust preventive composition consisting essentially of from about 2% to about 30% of a normal wax selected from the class consisting of sperm wax, hydrogenated sperm wax and mixtures thereof, from about 0.5% to about 10% of a surfactant selected from the class consisting of an alkaline earth soap of a preferentially oil-soluble petroleum sulfonic acid and a fatty acid ester of an anhydroalkitol, and from about 60% to about 97.5% of a hydrocarbon normally liquid diluent.

Electrostatic Coating Method

U. S. Patent 2,893,893. *July* 7, 1959. *W. W. Crouse, assignor to Ransburg Electro-Coating Corp.*

A method of electrostatically distributing liquids as a coating on an article.

Electrostatic Spraying

U. S. Patent 2,893,894. *July* 7, 1959. *E. M. Ransburg, assignor to Ransburg-Electro-Coating Corp.*

A method of electrostatically spray coating the surface of an article with liquid atomized from an annular atomizing zone.

Plating Method

U. S. Patent 2,893,929. *July* 7, 1959. *G. L. Schnable, assignor to Philco Corp.*

A method of gold-plating an n-type semiconductive body.

Plating Pretreatment

U. S. Patent 2,893,931. *July* 7, 1959. *C. B. Boyett, assignor to Terry Industries, Inc.*

The method of successively cleaning, deoxidizing and plating the surface of a metal comprising the sequential steps of directing a wet blast containing a suspension of a finely divided, cohesive abrasive against the surface to hone the latter until all foreign substances and oxides have been removed; continuing the wet blasting until a substantially air impervious layer of abrasive is formed on the surface to seal the latter from the ambient atmosphere; transferring the coated metal to a plating solution without interfering with said layer of abrasive on the metal and before any oxidation of the surface takes place; traversing the solution with an electric current sufficient only to cause enough gas to be evolved from the solution to thereby dislodge the abrasive on the surface of the metal; and after complete dislodgment of the abrasive, increasing the amperage of said current to plate the surface in said solution.

Brighteners

U. S. Patent 2,893,932. *July* 7, 1959. *H. Haas, A. Kirstahler, W. Gundel and W. Strauss, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

An electroplating bath for producing bright, ductile, non-porous electrodeposits of metals selected from the group consisting of nickel and copper, comprising an acid solution of an inorganic salt of the metal to be deposited and a brightening agent which produces bright, ductile, non-porous metal electrodeposits when used alone in said bath, said brightening agent being selected from the group consisting of organic compounds having the structural formula HAL—R—Q and their water-soluble salts, wherein HAL is a halogen radical, R is a hydro-carbon radical selected from the group consisting of aliphatic, cycloaliphatic and aromatic radicals, and Q is a water-solubilizing radical selected from the group consist-

ing of sulfuric acid ester, phosphoric acid ester, phosphonic acid, phosphinic acid, hydroxyl, ether alcohol and polyether alcohol radicals.

Nickel Plating Compositions and Method

U. S. Patent 2,893,933. *July* 7, 1959. *J. B. Winters and L. R. Westbrook, assignors to Incar, Inc.*

In the process of electroplating bright nickel from an aqueous solution of a nickel salt, the step comprising adding polyacrylamide to said solution in amount corresponding to between about 0.05 and about 0.5 gram per liter.

Electrostatic Spraying

U. S. Patent 2,894,175. *July* 7, 1959. *L. J. Lamm, assignor to General Motors Corp.*

Apparatus for charging particles of coating material, comprising: a spray gun having an atomizing portion including an elongated spray tube with a bore for the passage of air and liquid; a current collecting electrode formed of electrically conductive material and located adjacent and forwardly of said spray tube and comprising a venturi shaped annulus having a bore of large surface area relative to the bore of said spray tube, the bore of said annulus being concentric with said spray tube and flaring outwardly as it extends forwardly; a discharge electrode comprising a ring of electrically conductive material located forwardly of said collecting electrode and an array of attenuated discharge members extending radially inwardly from said ring into and positioned generally normal to the path of travel of atomized particles issuing from said spray tube; and a ring of insulating material between said current collecting electrode and said discharge electrode.

Apparatus for Electrostatically Applying Multi-Coatings

U. S. Patent 2,894,485. *July* 14, 1959. *J. Sedlacsik, Jr.*

Apparatus for electrostatically coating articles comprising an atomizer array for providing spray of coating material, conveyor means for transporting said articles along a predetermined loop bath through said spray, and means for creating an electrostatic field between said atomizer array and said articles for atomizing and depositing said coating material on said articles.

Electrostatic Spraying

U. S. Patent 2,894,691. *July* 14, 1959. *J. Sedlacsik*

An aero-electrostatic atomizing device attachable to a spray device receiving and discharging a supply of a fluent material and a motive agent and being adapted to electrically charge particles of the fluent materials discharged therefrom toward an electroconductive surface for deposition thereon.

Strip Galvanizing

U. S. Patent 2,894,850. *July* 14, 1959. *J. L. Greene and J. C. Holzwarth, assignors to General Motors Corp.*

A process for galvanizing a portion only of a ferrous metal article, the steps comprising applying an alkali metal aluminate solution to the portion of the article which is not to be galvanized, drying said coating, surrounding said article by a reducing atmosphere and subjecting said article to heat in a temperature range of from about 1250°F. to 1450°F. while surrounded by said reducing atmosphere for a time sufficient to reduce the oxides on said ferrous metal, and dipping said article in a galvanizing bath while still under said reducing atmosphere.

Coating Aluminum

U. S. Patent 2,894,852. *July* 14, 1959. *H. G. McMorris and F. H. McCall, assignors to Myron P. Laughlin*

An aluminum surface treating and coloring process which includes mechanically removing by means of impelled hard particles closely spaced particles from the aluminum surface to produce a pit pattern of not less than 60 depression lines per linear inch transverse to the longest surface dimension and filling such pits with color to produce a substantially solid color effect upon the viewing eye.

Continuous Galvanizing

U. S. Patent 2,894,856. *July* 14, 1959. *E. T. Schwendemann, M. J. Sadowsky, Jr., and E. Murway, assignors to Inland Steel Co.*

Continuous metal coating of a strip wherein the strip is passed through a bath of molten metal and thence upwardly between a pair of coating rolls partially submerged in the bath with an elongated pool of molten metal being formed in the nip between the rolls.

Ultrasonic Descaling

U. S. Patent 2,894,860. *July* 14, 1959. *E. A. Engelhardt, assignor to Capito & Klein Aktiengesellschaft*

A method of descaling metals, which includes the steps of: treating the metal to be descaled in an acid pickling bath for a period sufficient only for loosening the scale without completely removing same from said metal, transferring the thus pretreated metal from said pickling bath into a water bath, and treating the metal in said last mentioned bath by the action of cavitation caused by sound waves the energy of which measured on the metal to be descaled amounts to at least 2 watts per square centimeter.

Conversion Coating — Aluminum

U. S. Patent 2,894,865. *July* 14, 1959. *M. J. Pryor, assignor to Kaiser Aluminum & Chemical Corp.*

In a process for chemically coating aluminum and aluminum alloy products, of a nature such that entrapment corrosion presents a major problem, wherein said products are subjected to the action of an acid aqueous solution containing chromate ions, phosphate ions and fluorine ions as active coat-forming constituents to produce a coating on said surfaces, the improvement comprising the step of treating said coating with a rinsing solution containing a reducing agent that does not give insoluble oxidation products, said solution having a pH of about 3.0 to 7.0.

Method of Electropolishing Uranium

U. S. Patent 2,894,883. *July* 14, 1959. *D. E. Walker and R. A. Noland, assignors to the United States of America*

An electrolyte containing from 35 to 65% by volume of sulfuric acid, from 1 to 20% by volume of glycerine, and from 25 to 55% by volume of water.

Nickel Plating Uranium

U. S. Patent 2,894,884. *July* 14, 1959. *A. G. Gray, assignor to the United States of America*

The method of protectively coating uranium, which comprises anodically etching the uranium in an etch in an aqueous phosphoric acid solution containing chloride ions, cleaning the etched uranium in aqueous nitric acid solution, and promptly electroplating

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Robertshaw

MR. CONTROLS

the cleaned uranium in a nickel sulfate electroplating bath.

Copper Plating Uranium

U. S. Patent 2,894,885. *July* 14, 1959. *A. G. Gray, assignor to the United States of America*

The method of protecting metallic uranium, which comprises anodic etching of the uranium in an aqueous phosphoric acid solution containing chloride ions, cleaning the etched uranium in aqueous nitric acid solution, promptly electroplating the cleaned uranium in a copper electroplating bath, and then electroplating thereupon a metal selected from the group consisting of lead, tin, zinc, cadmium, chromium, and nickel from an aqueous electroplating bath.

Coating Material Pump

U. S. Patent 2,895,421. *July* 21, 1959. *D. J. Peeps, assignor to The DeVilbiss Co.*

In a pump of the type described, a unitary casing, a plunger reciprocably disposed in the lower portion of the casing, a stationary cylinder concentrically disposed within the casing above the area of reciprocation of the plunger, the stationary cylinder being sufficiently smaller in diameter than the casing to provide an annular space therebetween, and a piston of smaller diameter than the plunger and connected thereto.

Spray Painting

U. S. Patent 2,895,851. *July* 21, 1959. *W. L. Johnson, assignor to Abrasive Co. of America*

In a method for the application of spray paint to ferrous and nonferrous materials, the steps of maintaining about the material to be painted a magnetic field, mixing with the paint a pigment which is paramagnetic, agitating the mixture to maintain said paramagnetic pigment uniformly distributed throughout the paint, and thereafter spraying the resulting mixture upon the article, whereby the paramagnetic pigments are effective in guiding the paint particles toward the article.

Spray Nozzle

U. S. Patent 2,895,685. *July* 21, 1959. *D. J. Peeps, assignor to The DeVilbiss Co.*

A spray nozzle for atomizing a ma-

terial with compressed air and intimately mixing with the material an additive agent carried by the compressed air.

Spray Gun

U. S. Patent 2,895,686. *July* 21, 1959. *D. J. Peeps, assignor to The DeVilbiss Co.*

In a spray gun of the type described a main body member, a nozzle at the forward end of the body member for discharging air atomized coating material, means providing a coating material supply inlet adjacent the forward end of the body member and a passage for conveying coating material under pressure from the supply inlet to the nozzle.

Hot Dip Coating

U. S. Patent 2,895,845. *July* 21, 1959. *J. B. Jones and W. C. Potthoff, assignors to Aeroprojects, Inc.*

A method for continuously bonding a metal having a relatively low melting point to the surface of a moving strip of metal having a relatively high melting point which comprises coating the surface of the moving strip of higher melting metal with a molten mass of the lower melting metal at a temperature above the melting point of the lower melting metal and below the melting point of the higher melting metal, immersing the tip of a vibratory device in said molten mass of metal with the lowermost end of said tip being spaced from the surface of the metal having a relatively high melting point a distance of between 0.001 to 0.085 inch, exposing the molten mass of the lower melting metal to a sufficient amount of mechanical vibratory wave energy having a frequency of between 59 and 300,000 cycles per second to effect cavitation in said molten mass and bonding of the molten mass to the underlying metal surface, and then cooling said molten mass of metal to a temperature at which it solidifies.

Pickling Chromium-Steel

U. S. Patent 2,895,856. *July* 21, 1959. *T. Hong, assignor to United States Steel Corp.*

A method of removing scale from open-annealed chromium-containing steel comprising heating said steel to between 1100 and 1400°F. for at least one hour while in a reducing atmosphere containing at least about 5% carbon monoxide and at least about 10% carbon dioxide in a ratio of at least 2:1 and the balance substantially nitrogen and thereafter pickling said steel in an aqueous acid solution containing between 15 and 25% by weight of acid of the group consisting of sulphuric and hydrochloric acid maintained at a temperature between 150 and 200°F.

Plating to Controlled Thickness

U. S. Patent 2,895,888. *July* 21, 1959. *D. E. Varner, assignor to Industrial Nucleonics Corp.*

The method of electrodepositing a controlled thickness of plating on a continuous length of base material, which comprises conveying said base material lengthwise at a controllable rate through a plating bath, supplying said bath with a plating current of controllable magnitude for depositing a thickness of said plating material on said base material to form a plated material, initially maintaining a predetermined ratio of said current magnitude to said conveyor rate, removing electrolyte wetting a surface of said plated material traveling away from said bath, directing a beam of beta radiation into said traveling surface, quantitatively detecting reflected beta radiation returned backwardly from said surface to provide an indication of the thickness of plating on said surface, and correctively altering said ratio whenever said thickness indication deviates from a desired value.

ABSTRACTS

The Development of Non-Electrolytic Nickel Plating

N. A. Solowjow: *Vestnik Masstro* (Russia), **38**, #3, 82-84.

The advantages of the non-electrolytic nickel coating techniques can be summarized as the elimination of d.c. current equipment and the possibility of the application of a nickel coating of uniform thickness on parts with a complicated shape. A high-grade surface quality is obtained with satisfactory hardness, strength, and high wear-resistance.

In machine construction, the nickel has been applied as a wear-resistant deposit for applications such as piston rings, gear wheels, and similar parts, as well as for the repairing of worn parts, together with the coating of gauges, etc. where chromium plating is not possible.

Zinc Plating of Steel Sheets — Advantages — Results — Applications

By G. Pieltain, J. Deheneffe and P. Lemal; Paper read at the 6th. International Congress of Engineering Fabrication: Paris.

The thickness and uniformity of the zinc plated on steel is of great importance, as is the purity of the zinc. According to tests, zinc with only 0.05% of impurity, dissolves in decinormal hydrochloric acid about twice as quickly as that with 0.01%. Therefore, of 99.99% purity, electrolytic zinc is used for the anodes.

The thinner the protective coating, the more care is necessary with regard to its uniformity, so as to utilize the entirety of the zinc deposited. Zinc is not a noble metal and, accordingly, it should deteriorate fairly rapidly. Although atmospheric oxygen attacks zinc fairly rapidly, a coating of oxide is formed which serves to protect the underlying zinc. In time, this coating becomes porous and the attack then proceeds, but slowly at a rate which seems to depend upon a certain diffusion, either of the zinc towards the exterior or else of the oxygen towards the interior.

The life of a zinc coating should be more or less proportional to its thickness. It depends also on the exposure conditions, as the conditions given above concern a relatively dry atmosphere. If, before the protective coating of oxide has had time to form, the zinc is in the presence of humidity, the hydroxide is formed and subsequently, carbonate. If the atmosphere is highly industrial and contains sulfuric acid, then soluble zinc sulfate is formed.

Surface Treatment of Titanium

H. Richaud: Paper read at the 6th. International Congress of Engineering Fabrication—Paris.

The resistance of titanium to corrosion is due to the fact that the metal, as with aluminum, is covered with an adherent film of surface oxide. This oxide film is also responsible for the difficulties encountered in obtaining adherent plated coatings on titanium.

Three pickling baths can be used

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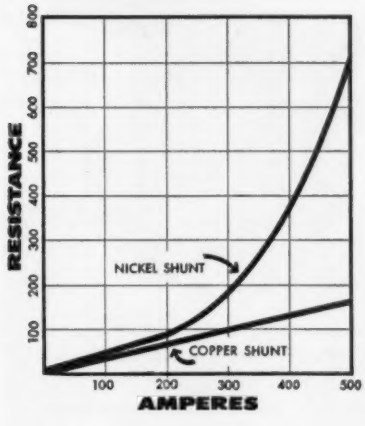

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for titanium. One procedure uses a molten mixture of soda (about 96%) and sodium nitrate (about 4%). This procedure dissolves the titanium oxide without attacking the metal but has the inconvenience of requiring an operating temperature of around 500° C.

The hydrochloric-hydrofluoric acid bath consists of:

Hydrochloric acid	15% by volume
Hydrofluoric acid (40%)	3-5% "
Water	Balance

The bath is operated at room temperature for some minutes, according to the degree of oxidation of the titanium. This bath is very vigorous; it attacks both the oxide and the metal and, thus, the treatment must be closely supervised. The finish obtained is a dull mat.

The third procedure uses a nitric-hydrofluoric acid mixture of the composition:

Nitric acid	20% by volume
Hydrofluoric acid (40%)	1-3% "
Water	Balance

The bath is operated at room temperature. This bath is less aggressive than the preceding one and produces a smooth surface. The color is a clear pleasant gray. It is used for the treatment of only slightly oxidized surfaces, or as a finishing treatment after first pickling in the hydrochloric-hydrofluoric bath.

The anodic oxidation of titanium is conducted in phosphoric or sulfuric acids. The author has found it best to work with a bath containing 20% by weight sulfuric acid (66° Bé) at 18 volts, and 20° C. An oxide skin is formed on the titanium metal, the color ranging from yellow to violet as a function of treatment time. The violet tint is generally obtained in 10 minutes.

The principal difficulty encountered in the electroplating on titanium arises from the fact that the metal is covered with a skin of natural oxide. It is necessary, therefore, to submit the titanium to a surface preparation which will render it capable of being covered with an adherent electroplated coating. Tests conducted by the author have shown the following two methods to be satisfactory. The first comprises deposition of electrolytic zinc; the second comprises production of a coating of oxide which serves as an anchorage for the plated coating.

As regards anodic oxidation and plated coatings on titanium it can be said that these treatments resemble those conducted on aluminum. Adherent deposits are obtained which can be used for decoration, to prevent seizure, or to facilitate forming and shaping.

Technical Problems in the Surface Treatment of Aluminum

F. Sacchi: *Aluminio* (Italy), **27**, #2, 63-71.

The author considered the principal present-day problems in the surface treatment of aluminum, with special regard to the structure of the anodized oxide and the sealing and fixing. Also considered were the problems of polishing, pickling, the after-treatment of cast parts, coloring component parts for architectural applications, and vitreous enameling of aluminum.

Decorative and Industrial Rhodium Plating

Deutsche Goldschmiede Zeitung, **55**, #12, 638.

As compared with gold plated coatings, rhodium deposits of low thickness provide extremely good corrosion protection. As the hardness of rhodium is much greater, they also have very much more wear resistance and are more durable than gold coatings of the same thickness.

Rhodium can be deposited directly on silver, gold, copper and copper alloys, nickel and nickel alloys. On tin, lead, zinc, cadmium, aluminum, and iron, inter-coatings of silver or nickel are absolutely necessary. Rhodium baths are acid and, consequently, attack many metals; copper, silver and mercury are particularly harmful if they pass into the rhodium bath. Consequently, the ware should only be placed in the rhodium bath with the current already switched on.

Of the various types, the sulfuric acid and the phosphoric acid baths are the most important technically. In decorative jewelry plating, the rhodium content of the bath is 2 to 3 g./l.

The bath voltage is about 2 volts; this voltage is independent of the electrode spacing. The current density can range from 0.3 to 2 amp./dm.^{2} It is an advantage however to work at the lower current densities (0.3 to 0.5 amp./dm.^{2}). The bath temperature is 30° to 40°C. Platinum is used exclusively as the anode material.

The ratio of anode-cathode surface should be 1:1 or more; it should not be smaller than this.

Recent Developments

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Rack Dryer

Baker Bros., Inc., Dept. MF, Route 138, Canton, Mass.

A new steam heated rack dryer is said to eliminate air hose and sawdust. This "little hot box" has successfully dried the most difficult electronic parts in a large precious metal plating shop, it is claimed.

The tank, with an overall length of 57″, is 36″ long x 30″ wide x 36″ deep, of $\frac{3}{16}$″ stock. It has 2″ of asbestos and air insulation, with 1½″ plugged side drain. The radiator, designed to receive 5 to 150 psi, has directional louvers for troubled recesses. It develops 150°F. at only 10 psi.

Paint Pump

DeVilbiss Co., Dept. MF, Toledo, Ohio.

A new, double-action pump, which simply screws into the bung of standard-sized closed drums of finishing materials and paints, has a two-to-one ratio, providing the capacity and pressure to supply two large, production type spray guns or the requirements of a small circulating system. The inlet extension tube automatically adjusts to the height of the drum and assures complete emptying.

Fast, sure valve action provides a steady, smooth delivery at the rate of 2.75 fluid ounces per cycle all common types of finishing materials and paints ordinarily shipped in closed top drums. Pressure regulator, gauge, safety valve, two air outlet valves, two fluid outlet valves, fluid bypass valve and return hose are included in the unit. For circulating systems, the pump is available with pressure regulator gauge and safety valve at less cost.

Water Wash Booth Compound

Frederick Gumm Chemical Co., Dept. MF, 538 Forest St., Kearny, N. J.

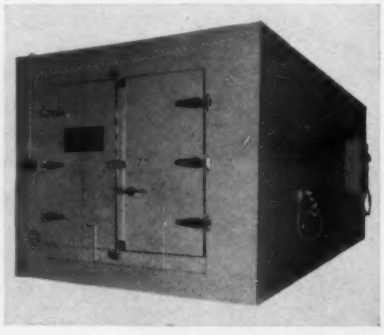
A waterfall spray booth stripper which prevents excessive foaming and keeps steel booth walls from corroding, Clepo 57-T is used in a continuous circulation system, and also permits reclamation of excess paint in many cases. As the paint is washed down from the walls into the circulating tank, it separates from the top of the wash water and can be drawn off into a separate reclaiming tank.

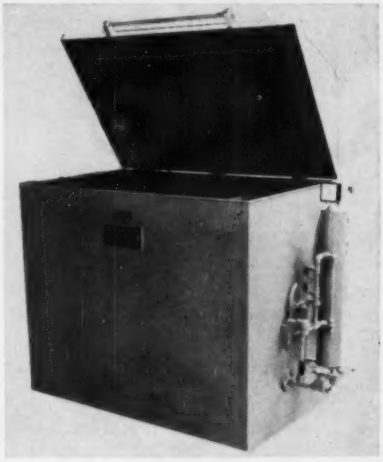
Corrosion Test Cabinets

Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 W. Ogden Ave., Cicero 50, Ill.

Newly designed accelerated corrosion testing equipment has been announced by the above manufacturers. The custom salt fog, humidity test cabinet design is a self-contained unit requiring no extra auxiliary tanks, mixers, pumps or auxiliary apparatus. All components are contained in a packaged unit.

Designed in sizes to accommodate test specimens, panels or entire product in simulated environments, the cabinets meet requirements of most federal and commercial test specifications. Standard size or special size





test cabinets to conduct "Cass," Corrodkote and other accelerated environmental tests requirements are designed and built to rigid specifications.

Cleaners for Ultrasonic Units

Clarkson Labs., Inc., Dept. MF, 930 N. Darien St., Philadelphia 23, Pa.

Each of these six new ultrasonic cleaners is designed for optimum efficiency in accomplishing a specific cleaning job. The range of cleaning covered by the six includes all normal ultrasonic metal cleaning jobs.

The series includes:

Sonic Duo Solve — a two-phase cleaner used cold to remove carbon, paint and other contaminants.

Sonic Solv — a blend of solvents and detergents for removing light soils from all metals. Used cold or to 160°F.

Sonic Copper Brightener — for cleaning and brightening copper, e.g., printed circuits and copper parts. Used cold or to 120°F.

Sonic Acid Strip — for removing scale, rust and heavy soil where acid cleaning of metal is required. Can be heated to limit of ultrasonic unit.

Sonic Alka Strip — an alkaline cleaner for heavy duty cleaning of steel

parts and magnesium alloys. Can be heated to the limit of the ultrasonic unit.

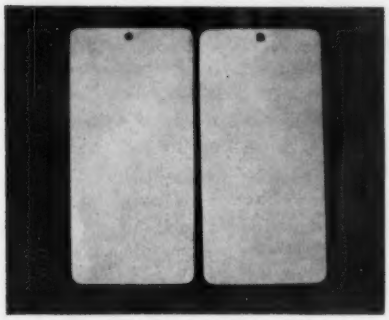
Sonic Aluminum Brightener — cleans, brightens, and deoxidizes aluminum and aluminum alloys. Used cold.

Porcelain Enamel for Magnesium

Dow Metal Products Co., Dept. MF, Midland, Mich.

A porcelain enamel finishing system for magnesium is considered to be a virtually fool-proof method of "painting out" the possibility of corrosion in magnesium alloys. It is also claimed to offer the usual advantages associated with porcelain enameling, such as attractive coloration and texture, and excellent resistance to abrasion, scratching and chemical attack.

Key to the new finishing system is a surface pretreatment which solves the adhesion problem that thwarted previous efforts to apply porcelain enamel to magnesium. The pretreatment makes possible the use on magnesium of standard lead-oxide or



Porcelain enameled panel of magnesium AZ31B alloy (right) compared to aluminum 61S-T6 panel after 500-hour salt spray test.

lithium-phosphate porcelain enamels already in use on other metals.

According to the manufacturer, porcelain panels of magnesium AZ31B alloy have withstood 500 hours of 20 per cent salt spray without corrosion. Panels with bared edges showed little edge corrosion. No "spall back" or undercutting because of corrosion at the edges was observed. Panels exposed to exterior weathering in an industrial atmosphere showed no corrosion and no spall back from the bared edges after five months. When panels were heated to 800°F. and immediately quenched in cold water, no spalling because of cold shock resulted.

The new finishing system cannot be used with magnesium alloys of high aluminum content and of high total

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The great success manufacturers of costume jewelry have found in Vacuum Metal Coating points the way for exciting sales possibilities for producers of items where eye appeal plays a part. Frequently, Vacuum Metal Coating eliminates the need for costly secondary operations and, in many cases, opens up new opportunities for enriching the appearance of the finished product. The cost savings, without deducting surface protection, may be substantial.

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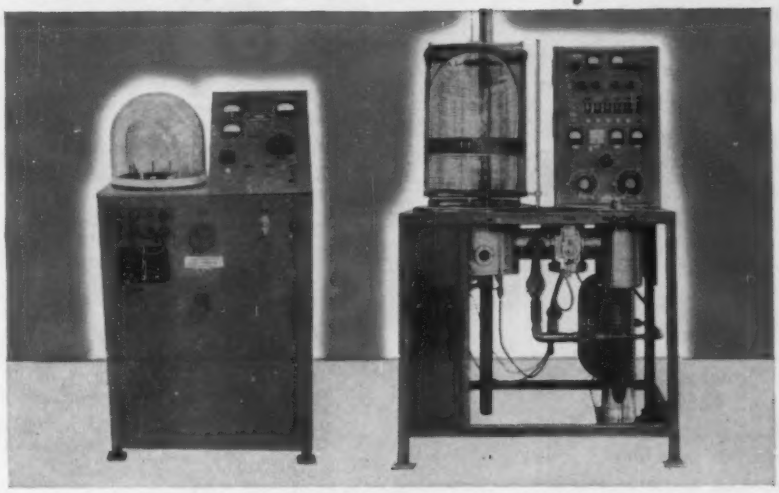

KINNEY High Vacuum Evaporators provide many special advantages not found in other equipment. There are sizes for pilot operation or large scale production. Illustrated are the SC-3 (left) and R-2H (right) popular models for limited output. Other models with horizontal or vertical chambers are available with chamber sizes to 6' x 6'. Send for literature fully describing KINNEY Evaporators on request. Ask about KINNEY Custom Evaporated Coating Service.

WRITE FOR BULLETINS 4100.1A AND 4100.1D CONTAINING FULL INFORMATION

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THE NEW YORK AIR BRAKE COMPANY
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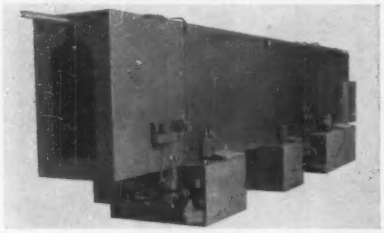
alloy content because these alloys contain low melting point eutectic. It has been used successfully, however, with the magnesium alloys of lower aluminum content, the magnesium-thorium alloys and the magnesium-rare earth metal alloys.

Power Spray Washing & Phosphating Machines

Ramco Equipment Corp., Dept. MF, 1379 Lafayette Ave., New York 59, N. Y.

Pre-engineered power spray washing and phosphating modules permit adding or modifying process stages economically as finishing requirements change. These standardized units eliminate time-consuming and costly custom designing, engineering and manufacturing of equipment to individual specifications. Five silhouette work groups of conveyorized monorail washing machines have six chemical process times cycles in each group. Based on the size of the work, number of finishing stages required and hourly production requirements, the proper units can be selected.



Designed and manufactured to give long, maintenance-free service, heavy duty, vertical, packless pumps are used with all plumbing headers internal to prevent external leakage and motor damage. Because of the compact design, enlarged spray manifolds and minimum piping, less pressure is required to operate pumps. Nozzle pressure is set exactly and controlled accurately by a throttling valve on the pump discharge. Two pressure gauges, one at the spray nozzle, the other at the pump's main discharge line, provide constant accurate pressure checks.

Seal-tight covers keep vapors and fumes from escaping and are easily removed for cleaning out sludge. A double screening filter system prevents sludge and other foreign substances from being drawn into the pump. The staggered spraying system utilizes veejet nozzles for high velocity impingement, with the minimum of splashing in the drain areas. Both steam heated and gas fired machines are available.

Vibratory Finishing Machine

Almco, Queen Products Div., King-Seeley Corp., Dept. MF, Albert Lea, Minn.

The new Model VT-72 Vibrasheen offers all the advantage of vibratory finishing of metal parts, such as deburring, descaling, cleaning, burnishing, and surface refinement, at greatly reduced time cycles as compared to ordinary barrel finishing equipment. The new unit has a 2½ cu. ft. capacity and has a standard vibrating frequency of 3380 cycles per minute.

A distinct advantage of the new unit is its compact design, which not only helps to reduce cost, but also cuts down on floor space requirements. Floor space needed is only 5½ sq. ft. The vibratory tub is fabricated of ¼" prime steel plate, all welded construction, and is mounted on coil springs in a heavy, rigidly gusseted frame. An air-actuated cylinder, controlled by a manually operated valve, can pivot the tub through an arc of 130° for easy loading and unloading. The tub is lined throughout with ⅜" plastisol for extremely long and trouble-free operation. The unit includes a fast-acting, cam-locking, perforated drain door to facilitate flushing of the tub. The vibratory mechanism is adjustable for an impact range of from 600 to 2500 lbs.

Electrical controls conform to J.I.C. specifications, with motor starter, disconnect switch, relays, and transformer mounted in a single NEMA type 12 enclosure. Operating push-button controls are on 110 volt current.

To facilitate loading, the hoist pan, Model HP-50, can be optionally used with the machine. A variable speed drive can also be optionally furnished to give a range of vibrating frequencies from 600 to 3380 cycles per min.

Cleaning-Phosphating Compound

Heatbath Corp., Dept. MF, Springfield 1, Mass.

A new product, Morphos, is available for simultaneous cleaning and phosphating of iron and steel articles in spray washing machines. It produces an amorphous-type iron phosphate coating to be used as a base for paint to prevent chipping and peeling, increase adhesion, localize corrosion should painted parts become damaged, increase over-all resistance to corrosion and to produce a more attractive finish with less paint. The product is sold as a powder and used 1 to 3 ounces per gallon in water. Time of treatment varies from 30 seconds to 2 minutes.

Water Filter

Scharf Mfg. Co., Dept. MF, 6120 Binney, Omaha, Nebr.

The Dynion water purifying filter is capable of removing suspended micro-size matter from ordinary tap water, and delivers pure, polished water so important in obtaining clean, unblemished work. It's installed with a minimum of plumbing to the cold water line.

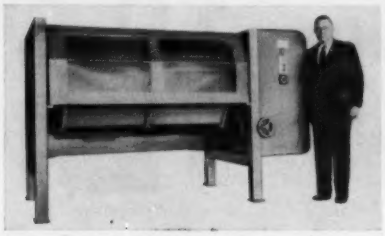
Hollow filter, high porosity candles impregnated with ional silver form the basic part of the filter. These ceramic tubes made of diatomaceous earth create instant, non-toxic purifying action. The micro-fine porosity of the candle walls traps and filters out all micro-size life, suspended solids and metal without changing the chemical content of the water.

Available in several sizes, from one candle to six-candle units, depending on the particular job specifications, the life of the filter is indefinite. Some have been in use for as long as ten years. Filters are simply brushed clean and need not be removed or replaced.

Barrel Finishing Machine

Rampe Mfg. Co., Dept. MF, 14915 Woodworth Ave., Cleveland 10, Ohio.

Capacity and precision control for large parts finishing, deburring, and polishing operations are now achieved in the Model V36 barrel finishing machine. The unit offers 36″ x 48″ and 36″ x 64″ barrel sizes with up to 40 cu. ft. total capacity. One- or two- compartment barrels are available to fit specific needs. Variable speed controls permit adjusting tumbling rates from 7 to 21 rpm.



Floating power drive, using an exclusive belt-and-gear power transmission system, provides smooth start-stop and quieter operation with reduced stress. Magnetic brake motor with remote control and overload protection is provided. A tachometer calibrated in barrel rpm can be furnished for precision work.

Acid Bright Gold

Technic, Inc., Dept. MF, P. O. Box 965, Providence, R. I.

Orotherm HT, a radically different 24Kt acid bright gold, is an entirely new gold complex offering many new application possibilities, especially where heat resistance is specified. Features claimed are:

Heat resistance 400°C.—5 hours minimum
No strike solution required
24Kt deposit—not an alloy
Greater wear resistance
Greater electrical conductivity
Brilliant deposit
Wide current density range 1-20 amp./ft.^{2}
Simple operation and definite control
No accumulation of deleterious sludges
Increased hardness — 150 + Knoop
Increased tarnish resistance
Wide temperature range 60°-115°F.
Tighter grained deposit
Better adhesion of deposit
Exceptional throwing and covering power
Reasonable cost.

SETHCO 'In-Tank' PUMP Outside FILTER SYSTEM

offers universal, self-priming, maintenance-free, leakproof operation

COMPLETE CHEMICAL RESISTANCE AND FULL-VIEW FILTRATION UP TO 250° F.

Filter pumps were not meant to be submarines. SETHCO detachable filter chambers are always outside the tank for full-view filtration, for swift cartridge cleaning without disturbing tank operation. SETHCO 'In-Tank' Pumps can be positioned just below liquid surface or can be equipped with extension strainers to filter at any level from tank bottom up. Pumps can be used for agitation or transfer. Harder working ½ or ¾ hp motors can accommodate all size filter chambers by throttling from open pumping capacities of 900 and 1800 gph to filter chamber capacities of 50 to 1200 gph.

SETHCO 'In-Tank' epoxy pumps are rugged and chemical resistant. They are available with Type #316 S.S., Hastelloy, titanium or epoxy glass pump shafts. Filter chambers are high temperature lucite or epoxy. SETHCO fully guaranteed filter systems are furnished complete, ready for immediate use.

Write for Spec. Sheet No. 751B and Complete Catalog No. M-1

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Demineralizer Service

DI Water Dept., Culligan, Inc., Dept. MF, Northbrook 7, Ill.

New portable demineralizers which connect at any plant water tap, will be furnished on a rental basis and will be maintained and serviced by a group of selected dealers throughout the country trained in the use of the demineralizers.

Company officials say the units can provide a dependable, uniform quality supply of demineralized water up to 40 gallons per minute. The equipment eliminates bottle handling, tank storage problems, hazardous chemicals and upkeep difficulties for users of distilled water. The demineralizers can be used for regular plant needs, short runs, or emergencies.

In the metal plating field the units can be used to maintain high quality final rinse water thus eliminating hand polishing or buffing caused by water spots. The water can also be used to make up plating baths.

Paint Stripper

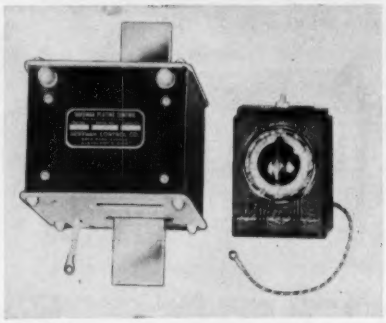
DuBois Co., Inc., Dept. MF, 1120 W. Front St., Cincinnati 3, Ohio.

Super Strypp is claimed to penetrate and alter the paint reins, lifting them from metal surfaces, especially acrylics, modified epoxies, heavily pigmented paints as well as film frequently left by ordinary alkaline paint strippers. It has solved the problem of removing pigmented drawing compounds and heavy soils previously hard to clean in most metal finishing shops, it is claimed.

Automatic Plating Controls

Hoffman Control Co., Dept. MF, 6804 Park Ave., Cleveland, Ohio.

Solving major problems and high costs of inaccurate or careless timing, for barrel platers using tank lines or automatics, is the new line of low-cost



DC-Matic Cut-Off Plating Controls.

The accurately controlled current cut-off feature conserves materials, electricity and manhours. Usual human timing errors and guesswork are prevented, assuring proper results while simplifying routine for operators and supervision. Barrels are moved while current is off; no arcing, explosions, splashing of solutions. It also prolongs service life of equipment; contacts stay cleaner, maintenance and excessive wear are reduced.

Easily installed, the controls are simple to use. The operator pre-sets timer to exact minute for optimum time-cycle. Green light signals current "on." At end of time-cycle, current is automatically cut "off;" green light goes out and red light glows until timer is re-set, cutting current "on" for next cycle. Supervision maintains visual control of all processing at a glance.

The controls are said to last indefinitely, require no maintenance, won't wear out, and are guaranteed for one year against defects and failure while operating within limits of manufacturer's specifications.

Paint Stripper

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

Quick Strip #5 is a new, non-inflammable alkaline organic solvent type paint stripper which is designed to first wrinkle paint, enamel or lacquer

coatings and then allow the wrinkled coatings to be flushed off with water. It will strip a variety of types of paint coatings, it is claimed, and is being used very successfully in removing many epoxy-resin type coatings, coatings which have posed a very difficult or almost impossible stripping problem in the field.

The strip is used as received, at room temperature, and can be used in steel tanks or containers over prolonged period of times without attacking the metal. It is also formulated to slow down considerably the evaporation of solvents, and contains inhibitors so that the total surface after the paint has been stripped will have nominal rust protection prior to painting. If stripping can only be accomplished by brush or spray application there is a #5 T vailable.

There is also a new #10 which is an alkaline salt mixture in which are incorporated the latest developments in basic chemical products. #10 is used one pound per gallon of water, and operated at 180°F. to boiling.

Chemical Polish for Stainless Steel

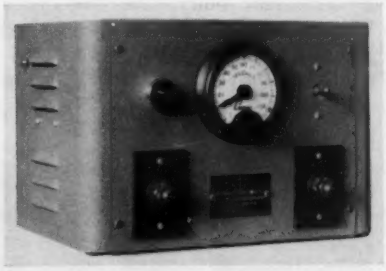
Chemclean Prod. Corp., Dept. MF, 15-08 121 St., College Point 56, N. Y.

Ox-Off Lustre Dip is a new chemical process that completely eliminates all forms of electropolishing, machine and hand buffing. By the simple method of immersing stainless steel in the dip for a short period of time, a mirror-like finish is imparted to the surface.

The product is shipped in non-returnable 15 gallon cubitainers.

Automatic Plating Timer

Macarr Inc., Dept. MF, 4360 Bullard Ave., New York 66, N. Y.



This timing panel is ideally suited for precious metal plating, and is designed to save labor, precious metal, and rejects. Briefly, the unit functions as follows: The timer will automatically start upon placing work on cathode rod, will time for the preset interval and, at the end of this time, will simultaneously operate a visual and audible alarm; and also reduce deposition to a very small proportion, thereby saving precious metals normally deposited due to lapse of time in the removal of work. Upon removal of work from the cathode rod, the timer will automatically reset and be ready for the next cycle.

Polishing and Buffing Machine

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Road, Detroit 20, Mich.

A new low-cost buffing and polishing machine for high-production, light-duty operations is ideally adapted to the finishing of such parts as nameplates, door handles, drawer pulls, channel extrusions, small moldings, hinges, cigarette lighter bodies, refrigerator shelves and ornaments.

Adjustable lathes may be positioned around the Jr. Straight-Line machine for tangent or wide-wheel, cross-cut buffing operations. Polishing heads and abrasive-belt arm attachments can be applied for strapping and contact wheel polishing-type operations for various deburring and blend purposes.

The machine consists of a 10-in. wide, 8-ft. long conveyor unit and suitable adjustable lathes that perform the buffing operations. Additional conveyor sections can be added when finishing requirements call for more lathes. The conveyor has a chain-type drive and individual platens that carry

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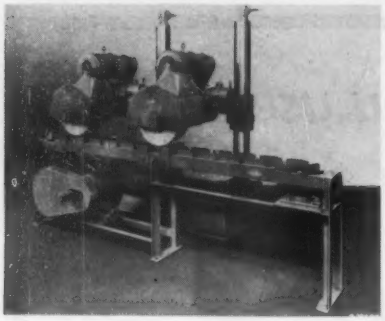


the work-holding fixtures. A ¾-hp motor drives the conveyor through a variable-speed drive that provides conveyor speeds from 10 to 30-ft. per minute. Part loading and unloading operations are carried out at one end of the conveyor.

The platens can be of either horizontal or follower-return type. This means that the part travelling on the return side of the conveyor can face in either the same or the opposite direction as those on the in-feed side.

Tinning and Galvanizing Flux

Westinghouse Electric Corp., Dept. MF, P.O. Box 2099, Pittsburgh 30, Pa.

A new fluxing additive acts as an adhesive to keep the flux close to the basis metal. The new additive, called Wes-X 501, eliminates the critical time between fluxing and hot dipping. In fact, parts have been flux dipped, allowed to dry, then hot dipped three weeks later with excellent results, it is claimed.

The flux additive makes hot dipping of cast parts easier, and can be used in any aqueous flux bath.

Ultrasonic Degreaser

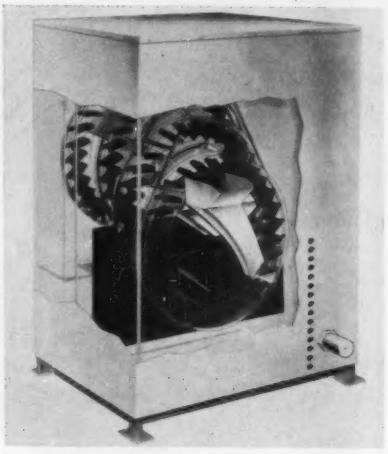
Metalclean Equip. Co., Dept. MF, P.O. Box 177, Bala Cynwyd, Pa.

An entirely new automated ultrasonic process integrates cleaning and degreasing with high speed production of metal parts. Called AutoSonex, it processes machined and sheet metal parts as fast as they come off automatic fabricators. The unit features a series of four rotating wheels with evenly spaced cubicles to hold the metal parts. As the parts move automatically through the series of wheels, they are first immersed in a degreasing solution, powered by ultrasonics, rinsed, then drained and finally passed through an isolated solvent drying chamber before being discharged.

The manufacturer says that flexibility in selection of solvents, water solutions and even acids, for cleaning and degreasing, as well as flexibility in design and size, make the machine adaptable for practically all metal parts industrial cleaning operations. Unique design of the machine and its up-ending action simplifies the cleaning and draining of parts with blind holes and liquid traps.

The standard medium size for most applications will take up a floor area only 28″ x 42″. It is movable and self-contained and claimed to be practically odorless, due to its special sealing arrangements to prevent solvent odor escape.

Drying facilities for water can be added. Larger, custom versions of the design can process several tote box loads per minute, using either solvents



or water solutions. The machine is electrically operated and requires only water and drain connections.

Airless Spraying Systems

Binks Mfg. Co., Dept. MF, 3114 Carroll Ave., Chicago, Ill.

The new basic airless spraying systems include a 55 gallon, and a 5-10 gallon outfit. With either system, paint is taken from the original container through the Pacer 300 high pressure pump. The pump delivers working pressures up to 3000 psi, when necessary, and supplies enough material to supply two spray guns if needed. The system comes equipped with durable low-cost nylon pressure fluid hose with re-usable hose fittings, or may be ordered with stainless steel hose. The Model 39 spray gun is especially designed for use with airless systems. A heavy production gun, it is equipped with a tungsten carbide tip for long wear. Each system comes with pump, agitator, elevator, fluid manifold and strainer and spray gun.

The 55-gallon unit fits directly on a 55-gallon material drum. The 5-10 gallon unit fits on a 10-gallon container into which a 5-gallon container may be placed. In either system, the material containers are not pressurized.

Either system may be operated from plant compressed air systems, or air from portable compressors. Minimum and maximum operating air pressures (input to pump) are 35 to 110 psi.

Spray Washer Compound

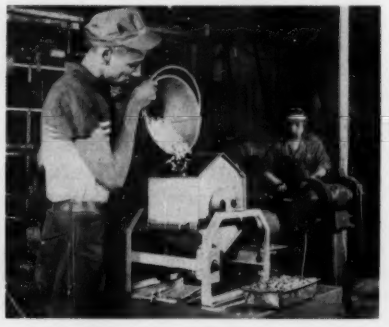
DuBois Co., Inc., Dept. MF, 1120 W. Front St., Cincinnati 3, Ohio.

No. 422, an alkaline cleaning compound for use in spray washing operations, is especially compounded for use on metals where hard water spotting and lime deposits are a factor and where the user wants to disperse pigmented drawing compound. It is claimed to reduce the need for presoaking or other auxiliary cleaning, in addition to stopping streaking and shadows on washed work. It retards the rusting of washed parts and is safe on aluminum, tin and most other soft metals. There is no danger of alkaline carry-over into the phosphating stage, because it rinses completely.

Barrel Finishing Machine

Chicago Wheel & Mfg. Co., Dept. MF, 1101 West Monroe St., Chicago 7, Ill.

Shops doing deburring, radiusing and finishing of small parts can now obtain a low cost, automatic, tumbling machine that's portable, economical, and ideal for close tolerance work. This is the new Handee Slide-Abrader. The operator loads the machine, sets the automatic timer, flicks the switch. While unattended the unit tumbles, finishing the parts, the operator is free for other tasks; the only labor involved is loading, unloading, and setting the timer.



Weighing only 64 lbs., with all steel construction, the tumbling machine enables a plant or shop to set up its own precision barrel finishing facilities in limited space at low initial cost, a minimum of labor, and practically no maintenance.

BUSINESS ITEMS

New R & D Group Leader Appointed by M & T

Dr. Alexander Ross

The appointment of *Dr. Alexander Ross* as organic group leader, Research & Development Division, has been announced by *Metal & Thermit Corp.* Previously, he was a research section chief with Olin Mathieson, and assistant research supervisor for Ethyl Corp. He received the B.S. degree in Chemistry from Wayne University, Detroit, and the M. S. and Ph.D. degrees in Organic Chemistry from the University of Michigan.

From 1943 to 1945, Dr. Ross was a first lieutenant and pilot with the U.S. Air Force.

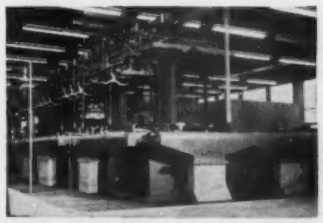
Promotions Announced by Magnus

Magnus Chemical Co., Inc., Garwood, N. J. announces two advancements in administrative positions and three promotions. *Edward H. Peterson*, formerly sales manager of the Chemical Division, has been named general manager of the company and its divisions. *Bernard H. Bailey*, formerly assistant technical director, has been appointed to the newly created position

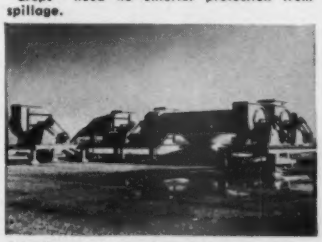
another corrosive fumes ventilating problem

Duracor Ventilation System exhausts 250,000 C.F.M. of corrosive fumes from large electronic equipment plant.

Strong, lightweight DURACOR ducts over 5 feet in diameter require minimum support.



Corrosion-proof throughout, these DURACOR "drops" need no exterior protection from spillage.



Weather and corrosion resistance are provided by DURACOR "T" sections on roof.

PROBLEM: This ventilating system had to withstand sulphuric, nitric, chromic, phosphoric acid and cyanide fumes emitted from the plant's plating and anodizing operation.

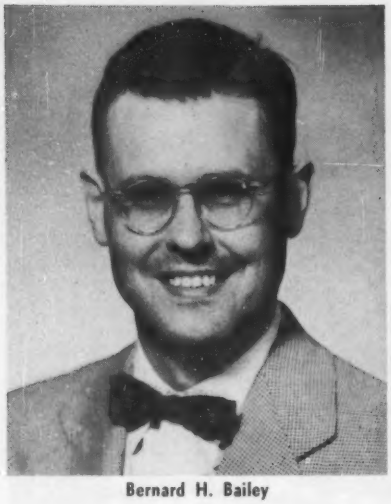
SOLUTION: Working from customer specifications, Ceilcote engineers built the entire ventilating system shown here completely from DURACOR.

INSTALLATION: Experienced Ceilcote supervisors and crews handled the complete installation under one contract. Materials and workmanship are fully guaranteed.

WHAT'S YOUR PROBLEM? . . . DURACOR resists any corrosive gas, fume or liquid . . . can be fabricated to virtually any shape. Write today and tell us about your requirements.

DURACOR CEILCOTE 8019-CC

THE CEILCOTE COMPANY, INC.
4844 Ridge Road • Cleveland 9, Ohio



Bernard H. Bailey

Edward H. Peterson

Alexander W. Bowling

of manager of the division.

Mr. Peterson has served in engineering and sales capacities since he joined the company in 1947. In 1952 he was appointed assistant to the president and in 1954 was made sales manager. He is also a member of the board of directors.

A graduate of Worcester Polytechnic Institute, Mr. Peterson holds a masters degree from Stevens Institute of Technology and a Ph.D. in business administration from New York University. He is a member of the American Management Association and a licensed professional engineer.

Mr. Bailey joined the firm in 1952, serving as field service engineer in Massachusetts and New Hampshire. In 1954 he was made assistant technical director at the headquarters in Garwood.

Mr. Bailey is a graduate of Oberlin College where he received a B.A. degree in chemistry. Before joining the company, he was associated with Boston Varnish Co. as superintendent of the resin plant.

Alexander W. Bowling, formerly sales manager, has been appointed manager of the Equipment Division. He succeeds *Marcel Zinty*, retired, but who is being retained as a consultant. *P. Edward Gabelmann*, formerly production and purchasing manager, has been advanced to technical director of the division. *Henry A. Rowan*, project engineer, has been made chief engineer.

Mr. Bowling, who joined the firm in 1946, is also secretary and a director of the company. He is a graduate of the University of Baltimore. He served during World War II in the Air Transport Command and was released with the rank of Lieutenant Colonel.

Gabelmann, who is also a director of the company, has been with the firm since 1941. He graduated from New York University with a mechanical engineering degree. Before joining Magnus, he was associated with the Carrier Corp.

Mr. Rowan, who joined the firm in 1946, is a graduate of Purdue University with a B.S. in aeronautical engineering. He is a licensed professional engineer and s a member of the New Jersey Professional Engineer's Society and the National Professional Engineer's Society.

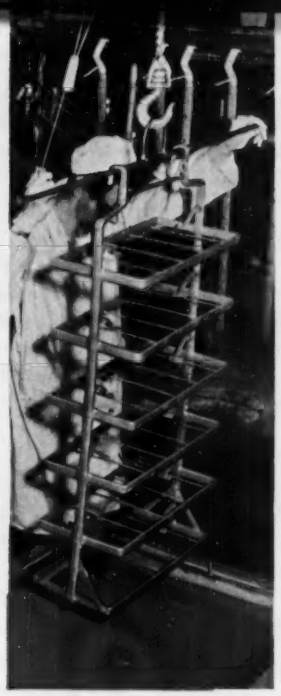
M&T Appoints Vice Presidents

The appointment of *James L. Oberg*, *Donald W. Oakley* and *Harry W. Buchanan* as vice presidents of *Metal & Thermit Corp.*, was announced recently. Mr. Oberg, who will continue in his present assignment as general

P. Edward Gabelmann

Henry A. Rowan

James L. Oberg



Why do 2 out of 3 leaders in the appliance field prefer to work with Coating 218X? Because it assures better control not only of plating quality . . . but also costs.

It's a proven fact. This vinyl plastisol rack coating is so tough and durable, it survives thousands of cycles in severe plating service.

Only Unichrome Coating 218X has a built-in cure indicator to assure optimum toughness. It can't contaminate bright nickel or other sensitive plating baths. If ever necessary, it can be patched and *rebaked* without harm.

Follow the lead of the leading companies. Verify for yourself that using the best quality at the outset saves money in the long run. Coating 218X is available from expert applicators around the country, or can be applied right in your own shop. Send for details. METAL & THERMIT CORPORATION, Rahway, New Jersey.

M&T **coatings and finishes**
METAL & THERMIT CORPORATION

14 OF THE 22 LEADERS IN THE APPLIANCE INDUSTRY

...coat plating racks with Unichrome Coating 218X!

Photo courtesy of General Electric Co.

Harry W. Buchanan

Donald W. Oakley

manager of the Metals and Minerals Division, joined the firm in 1955 as technical advisor to the president. In August, 1959, he was appointed general manager of the division with responsibilities for research, production, sales, and technical service.

Mr. Oberg also is a vice president of International Titanium Corp., and supervises its operations and those of its wholly-owned subsidiary, Metal Recoveries Proprietary Ltd. in Australia. He received the B.S. degree in Metallurgical Engineering from Lehigh University, and completed the training course for senior executives at M.I.T. A registered professional engineer (Ohio), he is a member of American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, and American Welding Society. He holds patents in the welding equipment and heat exchanger construction fields.

Mr. Oakley will retain his present assignment as general manager of the Coatings Division, responsible for manufacturing, sales, research, and merchandising. He joined the company in 1947 as a research chemist, and subsequently became manager of the Manufacturing Division. In mid-1959 he was appointed general manager of the newly formed Coatings Division.

Mr. Oakley received his B.S. and M.S. degrees in Chemical Engineering from Columbia University, and later attended the Columbia University School of Business. A past chairman of the New Jersey section, American Institute of Chemical Engineers, Mr. Oakley presently serves on the national program committee.

Mr. Buchanan will retain his present assignment as manager of the general sales department. He is responsible for the direct selling and distribution of the company's manufactured products, including supervision of regional managers.

Mr. Buchanan was appointed manager of the general sales department in mid-1959. Prior to this he was sales manager for the firm's chemicals, metals, and plating products. He joined the company in 1947 as a chemical engineer. He received the B.S. degree in Chemical Engineering from Rensselaer Polytechnic Institute, and the M.S. degree in Industrial Management from Massachusetts Institute of Technology on a Sloan Fellowship.

He is a member of the Society of the Plastics Industry, Society of Plastics Engineers, American Electroplaters' Society, American Chemical Society, and the Chemists' Club.

Correction

Due to one of those gremlins known as a typographical error, it is incorrectly stated in our January issue, page 100, that Kelite Corp. recovered damages from Klem Chemicals, Inc., among others. This should have read Khem Chemicals.

Neilson Appoints New Representative

Robert F. Poyton, 23 Mather Ave., Edgewood 5, R. I., has recently been appointed as sales and service representative in the New England area by the *Neilson Chemical Co.*, 2300 Gainsboro, Detroit 20 (Ferndale), Mich. Mr. Poyton will receive training in the company laboratory where metal finishing chemicals and compounds are being tested under actual production conditions. Following this, he will be available for service to accounts in the New England territory.

Northwest Chemical Co. Adds Representative

Northwest Chemical Co. announces the appointment of *Paul V. Dugan* as their representative in the Southwest Ohio territory. He will work with *Richard Jager*, who has served the metal finishing industry in this area for many years.

Mr. Dugan's experience as an automotive chemist and plating shop superintendent, coupled to his academic training, will make it possible for him to offer unique skills and knowledge to the trade.

DeVilbiss Appoints Bohon Manager of Industrial Sales

The appointment of *D. L. Bohon* as manager of industrial sales has been announced by the *DeVilbiss Company*. *E. F. Frey*, who has been manager of industrial sales, will continue to serve as sales liaison officer between the industrial and jobber sales divisions and take on the additonal duties of correlating sales efforts on metal fabricators products.

Mr. Bohon has been with the company since 1939. After service with the Air Force in World War II as an intelligence officer in the European theater, he returned to the company's West Coast branch as office manager. In 1950 he was made West Coast regional sales manager, and two years ago he was transferred to Toledo to serve on the staff of the sales vice president.

D. L. Bohon

A native of Appleton, Wis., he attended LaCrosse State College before moving to the West Coast.

Changes at DuPont

John F. Daley retired recently as a vice president and member of the executive committee of the *Du Pont Company* after a career of nearly 45 years. He retains his position as a member of the board of directors.

At the same time, *Colgate W. Darden, Jr.*, was elected a member of the Board to fill the vacancy created by the resignation of *Alfred P. Sloan, Jr.*, in November. Mr. Darden, who has been a member of Congress, Governor of Virginia, and most recently president of the University of Virginia, is now living in Norfolk, Va.

Mr. Daley, who has reached the retirement age of 65 years, has been a vice president, member of the executive committee and a member of the board since 1956. He had previously headed two of the company's operating departments. He was general manager of the Pigments Department from 1944 to 1948 and general manager of the Organic Chemicals Department from then until he stepped up to the vice presidency.

Gumm Chemical Names Sales Representative

As part of a sales expansion program, *Frederick Gumm Chemical Co.*, 538 Forest St., Kearny, N. J., has named *Richard McDowell* as a technical sales representative for its line of plating and metal finishing compounds in southern and northwestern Ohio. The new sales territory will include the

Richard McDowell

NEW STOKES 72" VACUUM COATER

Shortens cycles, speeds production and provides more flexible operation

A highly versatile pumping system is the chief reason behind the increased efficiency and flexibility of Stokes new 72" Vacuum Coater. Employing a new "modular" approach to vacuum system design, the new arrangement provides greater pumping capacity and operating versatility . . . at no increase in cost. Pumping down the clean dry chamber can now be accomplished in 4½ minutes or less.

Here's how the modular system works: two separate but identical "teams" of pumps are connected independently to the vacuum chamber. In normal operation both "teams" are used. However, either team may be cut out for periodic maintenance or isolation without shutting down the entire metallizer. It's a real time and cost saver. And to make the equipment even more versatile, a third pump can be easily added.

The new "modular" approach is one more example of progress in vacuum technology at Stokes. Whether it's vacuum metallizing of decorative parts or high-precision components, Stokes experience helps lead the way to greater operating efficiencies. Why not find out how Stokes will help plan your metallizing facilities . . . select the proper equipment . . . train operators. Your nearby Stokes field engineer will be glad to discuss your particular requirements . . . and to make available the facilities of Stokes Laboratory and Advisory Services.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

cities of Cincinnati, Columbus, Toledo and Dayton.

Mr. McDowell will maintain offices at 3854 Kenswick Lane, Dayton. A member of the A.E.S. with fifteen years of experience in the metal finishing field including production and job shop plating and barrel finishing, for the past six years he has been active as a technical service representative in this area.

Changes at Minnesota Mining

Several changes in the sales organization of *Minnesota Mining & Manufacturing Co.'s* coated abrasives and related products division have been announced recently.

F. M. Metcalfe has been named division sales manager and *C. L. Murphy* has been named division marketing manager. Also announced was the appointment of *W. E. Marsden* to eastern region sales manager for the division.

Metcalfe, who will be responsible for all field sales operations, has been with the firm since 1935, and was regional sales manager headquartered at the New York area office before assuming his new duties. In his new post he will headquarter in St. Paul.

Murphy, who will be responsible for all divisional marketing activities, was industrial trades sales manager for the division before being named to his new post. He joined the company in 1942.

Marsden was automotive sales manager before assuming his new duties. He has had 20 years of sales experience with the firm.

Bay Firm Purchased

William J. Saunders, Los Angeles industrialist, has acquired controlling interest of *Hardco of California, Inc.,* metal finishers of Berkeley and San Carlos, and has become the firm's president and chairman of the board of directors.

In addition to Saunders, other newly-elected director-officers are *Arthur K. Lovatt,* president of Lovatt Associates, management consultants of Los Angeles and Berkeley, vice-president and treasurer; and *Harold Newrock,* attorney of Whittier, Calif., secretary. Non-officer directors are *Tom Hudson,* attorney of Carmel, Calif., and *Vernon Sellers* of San Jose.

With two facilities in the Bay area, Hardco is one of the leading firms of its type in Northern California. The general offices and plant No. 1, located at 1235 Fifth St., Berkeley, provide architectural metal finishing services for industrial and commercial construction projects. Plant No. 2, located at 1015 Terminal Way, San Carlos, undertakes metal finishing for both defense and commercial work.

Hercules Appoints Sheffield

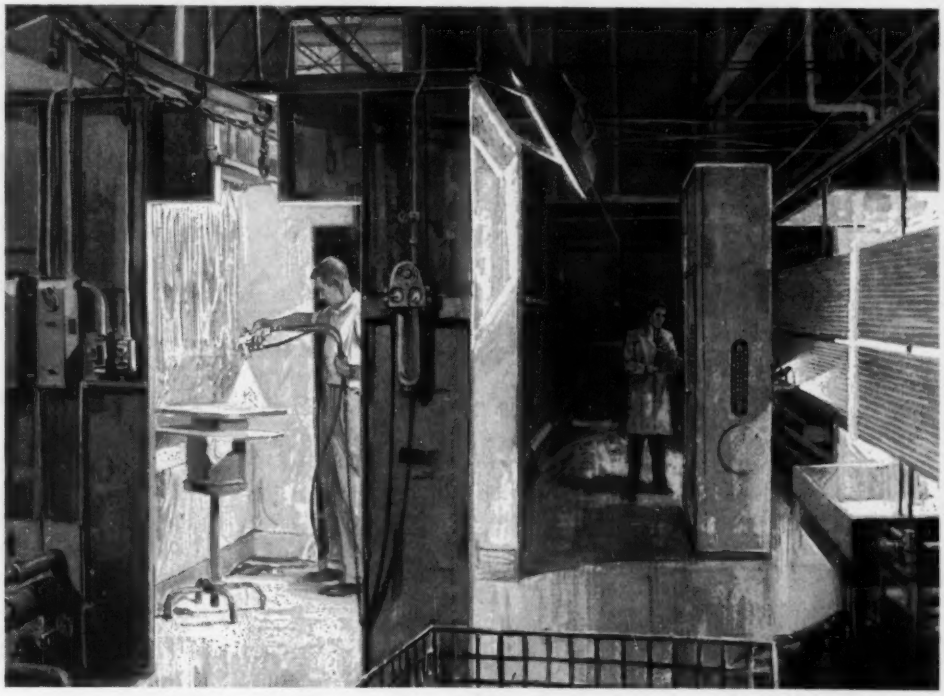
Donald H. Sheffield, of West Chester, Pa., has been appointed general manager of *Hercules Powder Co.'s* Synthetics Department. Mr. Sheffield,

Spray, dip, or flow coating . . .

DeVilbiss total

can help determine the best method for you

You get an unbiased recommendation from DeVilbiss—the only company that manufactures a complete line of coating equipment, from spray guns to engineered finishing systems. Trained engineers provide total service from initial planning to operator training. Our customer research laboratory will run comparison tests of your products for results that reveal what method is best for you. Or our engineers will suggest ways to make your present system more efficient with minimum changes. Let DeVilbiss total service help you. The DeVilbiss Company, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Offices in principal cities.



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DEVILBISS

Dip coating

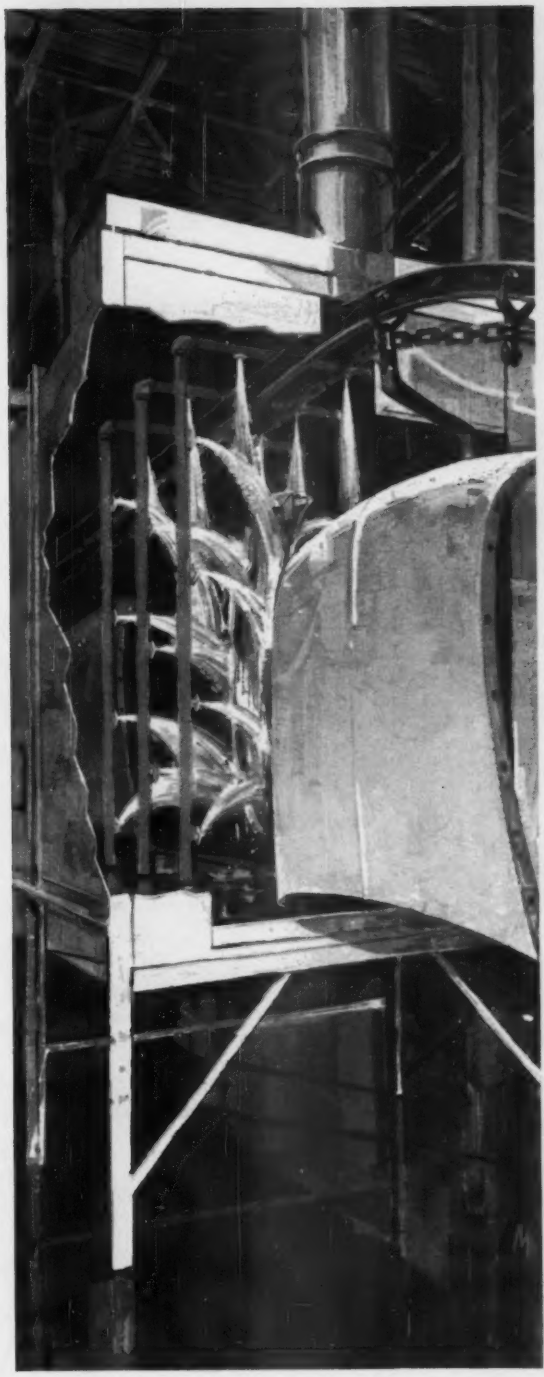
Continuous process or batch type, with scientific vapor and viscosity controls to ensure uniform finishes

Flow coating

Saves man power, floor space in prime- or single-coat applications

Spray coating

DeVilbiss manual and automatic equipment efficiently coats products of any size or shape



who has been assistant general manager of Synthetics since December 1955, will succeed *Henry A. Thouron*, who has been named general manager of the newly created International Department.

Born in Springfield, Minn., Mr. Sheffield attended schools there, and majored in chemistry at Carleton College. He obtained his Master's degree in organic chemistry from Ohio State University, and in 1953 attended Harvard Business School's Advanced Management Program.

In 1929, he entered the employ of the company as a chemist at the experiment station, then located in Kenvil, N. J., being transferred shortly afterwards to the company's naval stores plant in Brunswick, Ga. In 1940, he was transferred to the home office in Wilmington as assistant to the director of operations of the Naval Stores Dept. He was manager of development from 1948 to 1951, and was named assistant director of operations early in 1952.

When the company branched into a new field, that of oxychemicals, in 1955, Mr. Sheffield was named to head the division.

Sales Representatives Appointed by Tumb-L-Matic

The appointment of two new sales representatives has been announced by *Tumb-L-Matic, Inc.*, manufacturers of tumbling equipment and tumbling compounds.

Thomson and Willett Co. of Haverford, Pa., has been assigned the eastern Pennsylvania, southern New Jersey, Delaware and Maryland territory. *Joseph Upton, Jr.*, New York City, will cover metropolitan New York, northern New Jersey and the Hudson Valley section as far north as Schenectady.

Wheelabrator Acquires Lord Chemical

Wheelabrator Corp., Mishawaka, Ind., manufacturer of blast cleaning equipment, steel abrasives, and dust and fume control equipment, has acquired approximately 80% of the controlling stock of the *Lord Chemical Corp.*, York, Pa. As a majority-owned subsidiary, Lord will continue to operate in York, manufacturing its line of vibratory and barrel type finishing equipment and supplies. Organized in 1951, the company has achieved prominence in pioneering the revolutionary vibratory precision finishing process.

Officers of Lord Chemical include: *James F. Connaughton*, chairman of the board; *H. R. Stitely*, president; *J. A. Schmidt*, secretary-treasurer of Wheelabrator, elected to vice president-treasurer of Lord; *H. E. Smith*, elected to secretary; and *J. M. Wolf*, controller at Wheelabrator, appointed controller of Lord.

McGuire Named V. P. of The DeVilbiss Co.

T. Kenneth McGuire

T. Kenneth McGuire, of Detroit, has been named a vice president of *The DeVilbiss Co.*, leading manufacturer of paint spray and allied equipment. Vice president and general manager of a subsidiary, DeVilbiss Metal Fabricators Co., Mr. McGuire was elevated to an officer of the parent company by action of the board of directors. He will continue to direct the activities of the subsidiary company.

Mr. McGuire has been general manager since May 1959, moving up from the post of vice president-sales upon the death of his predecessor. He joined the subsidiary company in July 1958 when that company took over the contracts of the Peters-Dalton Div. of Detroit Harvester Co. He had been with Peters-Dalton since 1945, starting in the engineering department and progressing through sales to the post of sales manager.

Previously, he was in the drafting department of the fabricating shops of Ford Motor Co. from 1934 through 1945.

Wes-X Products to be Distributed by Promat

The Promat Division of *Poor and Co.* has been named a distributor for *Westinghouse Electric Corp.'s* electroplating additive agents. Promat, with manufacturing facilities located in Waukegan, Ill., and Gardena, Cal., has dealers located in all areas of industrial concentration in the United States.

A complete line of Wes-X additives for plating baths will be stocked so metal finishers can be assured of rapid delivery of these products.

Livingston Elected by Chemclean Products

Ira R. Livingston has been elected executive vice president in charge of sales of *Chemclean Products Corp.* at a recent meeting of the board of directors. With the company for eight years in administrative and sales capacities, Mr. Livingston has been active in selling to users in the welding and metal fabricating fields. He announced that applying his experience to broaden distribution of the company's products in these industries will be one of his early objectives.

Schaffner Mfg. Co., Adds Facilities

Schaffner Mfg. Co., Inc., announces the addition of 25,000 square feet of floor space to the corporation's manufacturing facilities.

Morriss Joins Hubbard-Hall

Robert F. Morriss

The *Hubbard-Hall Chemical Co.* has announced the appointment of *Robert F. Morriss,* South Amboy, N. J., as metal finishing and supply field representative in New Jersey and Metropolitan New York. He has had 15 years experience in the metal finishing industry and comes to the firm from the Hanson-Van-Winkle-Munning Co.

Dearborn Chem. Co. Opens New District Office

Dearborn Chemical Co., manufacturers of water treatments and coatings for corrosion control, has announced the opening of an Indiana-Michigan district office at 3001 Fairfield Ave., Fort Wayne, Ind.

The new office will be under the direction of *T. J. Weisbruch,* district manager.

Siefen Compounds, Inc. Opens Plant in Syracuse

Siefen Compounds, Inc. has announced the opening of a new plant for the manufacture of liquid buffing and polishing compounds at 675 Oswego Blvd., Syracuse 8, N. Y.

The addition of this new plant will double the production facilities of the company and will provide better service to customers in the eastern part of the United States. The present plant at 14325 Wisconsin Ave., Detroit 38, Mich., will continue to service the West.

Rinshed-Mason Co. Appoints Sales Manager

O. B. Middlebrook has been appointed sales manager of litho coatings for the *Rinshed-Mason Co.*, industrial finishes manufacturer. With the firm for the past 10 years, Middlebrook will continue to headquarter in Detroit.

H. K. Porter Acquires Patterson-Sargent Paints

H. K. Porter Co., Inc., diversified Pittsburgh-based industrial manufacturing concern, has recently purchased over 90% of the stock of *The Patterson-Sargent Co.* of Cleveland, Ohio, manufacturers of "BPS" paints for home and industry. It will be operated as a subsidiary of the company, and no changes in the Patterson-Sargent organization have been announced.

U. S. Stoneware Appoints Doria

Appointment of *Gabriel F. Doria* as technical representative is announced by *The U. S. Stoneware Co.* He will

Gabriel F. Doria

work out of the New York City offices, 60 East 42nd St.

For the past three years Doria has been a sales engineer for Graver Water Conditioning Co. Previously, he had served as a chemist with Bennett's Chemical Distributors Co. and had worked in laboratories of Tide Water Associated Oil Co. and Dodge & Olcott Co.

A graduate in chemistry of Seton Hall University, Doria is a veteran of military service in the U. S. Army Medical Corps.

Diamond Alkali Promotes K. W. Marty

Kenneth W. Marty, senior chemist in the planning & economics section of *Diamond Alkali Co.'s* Research Department, Painesville, O., has been promoted to the technical service staff of the Chlorinated Products Division, Cleveland. At his new post, Marty assumes responsibility for technical service to customers in the solvents and Chlorowax fields.

He joined the organization in July, 1950 as a chemist in the Research Department and has since served in various sections including analytical, administrative, and planning & economics.

A 1948 graduate of Kent State University, Kent, O. with a B.S. degree in Chemistry, Marty also attended Penn State University, State College, Pa. to further his studies of chemistry.

He is a U. S. Army veteran and holds membership in the American Chemical Society, National Management Association and Diamond Technical Society.

Amatex in New Quarters

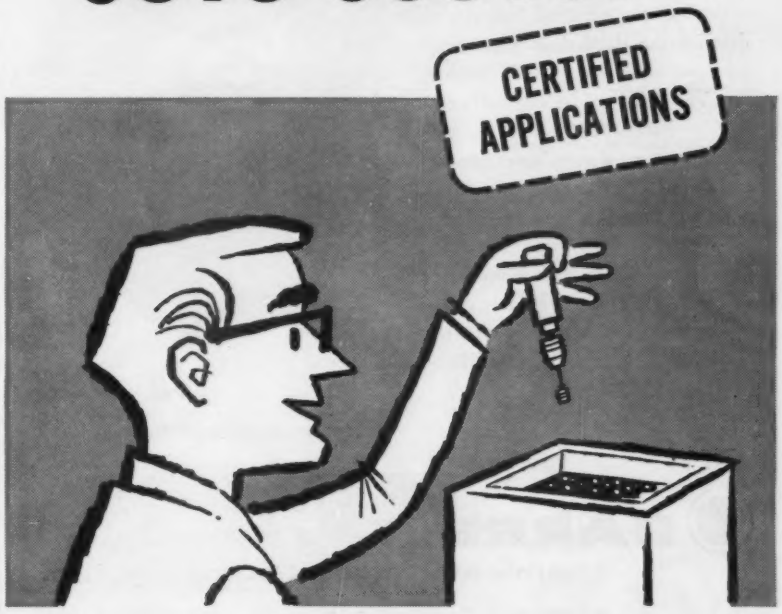
Amatex Corp., buffing wheel manufacturer, has moved to new and larger quarters, to better serve the metal finishing industry. The new location is at 224 Empire Blvd., Brooklyn 25, N. Y., telephone BUckminster 7-9150.

Mattiat Joins Acoustica

Dr. Oskar E. Mattiat, well-known authority in the acoustics field, has been appointed chief scientist of *Acoustica Associates, Inc.*, of Plainview, N. Y., and Los Angeles.

Dr. Mattiat, who received his Ph.D. in Germany, has been engaged in the development of acoustic systems and piezoelectric devices since 1934 at the German General Electric Co. in Berlin, the Clevite Research Center in Cleve-

ACOUSTICA ULTRASONIC CLEANING CUTS COSTS!



Much better cleaning!
Much less time!

In seconds—all dirt, dust, and soils are "cavitated" away *ultrasonically!* No scrubbing, no disassembling, no costly maintenance. Hard-to-get-at parts are cleaned swiftly and thoroughly. Modern Acoustica ultrasonic cleaning is rapidly replacing older methods. Send for details of complete line of Acoustica ultrasonic equipment and cleaning chemicals. Acoustica Associates, Inc., Fairchild Court, Plainview, N. Y. • 1042 Aviation Blvd., Los Angeles, Calif.

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ULTRASONIC CLEANING SYSTEMS

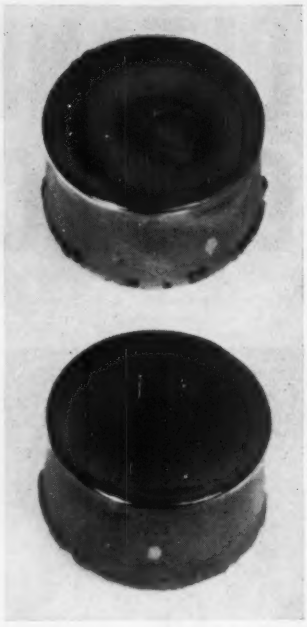
high TEMPERATURE PROTECTION

Barrett Sulfamate Nickel withstands 2300° F. temperature as these two nickel plated copper discs indicate after exposure to thermal shock in a solar furnace.

The top disc, exposed for 2 seconds, shows deterioration of Watts type nickel. The bottom disc, exposed four times longer and plated with Barrett Sulfamate Nickel, indicates no deterioration. Both discs were plated with a 0.007" deposit.

The ability of Barrett Sulfamate Nickel to withstand the high temperature, due to lower porosity and denser deposit, resulted in plating the first successfully recovered nose cone with this process.

Moral: Where high temperature protection and a stress free nickel deposit is required . . . use Barrett Sulfamate Nickel.



Request Bulletin SN-2

BARRETT
chemical products company, inc.
Shelton • Connecticut

Dr. Oskar E. Mattiat

land and, more recently, at the Astrophysics Development Corp. division of Curtiss-Wright Corp. in Santa Barbara, Calif.

Dr. Mattiat, who is a Fellow of the Acoustical Society of America and editor of the Transactions of the Institute of Radio Engineer's Professional Group for Ultrasonic Engineering, has made outstanding contributions in the fields of microphones, submarine detectors, wave filters and ultrasonic cleaning systems. Dr. Mattiat will have his headquarters in Los Angeles.

Baird Machine Appoints Bennett

Baird Machine Co., manufacturers of industrial equipment, recently announced executive promotions in the

C. B. Bennett

organization, one of which is of interest to the finishing field — the appointment of *C. B. Bennett* as sales manager of the barrel finishing equipment division.

Mr. Bennett was formally employed by the Harvey Hubbell Co. of Bridgeport, Conn. He makes his residence in Stratford, Conn.

Amchem Transfers Taylor

Amchem Products, Inc. announces the transfer of *Robert W. Taylor* to Kansas City, Mo., as the technical sales representative for the Metalworking Chemicals Division of the company. Taylor will be attached to the Central district office, located in St. Joseph, Mo. His new territory will include Missouri, Kansas, Colorado and Nebraska.

Nu-Matic Moves Manufacturing Facilities

Nu-Matic Grinders Inc. of Cleveland, Ohio announces it has moved its headquarters and manufacturing operation to 875 East 140th St., Cleveland 10, Ohio.

Floor space at the new location is three times the space formerly occupied and the additional space is necessary because of the firm's vastly expanded product line.

Ceilcote Creates New Department

The *Ceilcote Company* has announced the formation of a Process Equipment Department to develop and market a complete line of standard as well as custom reinforced plastic fabrications for processing highly corrosive fumes and fluids. *Stanton V. Sheppard*, formerly chief engineer of Ashland Oil & Refining, has been ap-

Stanton V. Sheppard

pointed manager of the new division.

A graduate of Purdue University, Mr. Sheppard is a licensed professional engineer and an active member of the Cleveland Engineering Society.

V. J. Dolan and Co. Building New Plant

V. J. Dolan & Co., Inc., Chicago, manufacturer of industrial finishes, has announced that construction has already begun on a new modern fire proof plant, complete with underground tanks and automatic pumps. The new unit will be located on company property facing one block west at 1825 North Latrobe and will be used exclusively for the manufacture of stains, fillers and multicolor.

This expansion program will double the capacity of the present plant and allow for the addition of modern equipment needed for increased production.

America looks to . . . Hammond
for
FINISHING
and
DEBURRING
"KNOW-HOW"
The experience gained in over 70 years of machinery building has provided us with a big bank of "Know How."
This knowledge is drawn upon and added to every day. Our business is to share it with you to bring down high finishing costs. Many users of Hammond Automatics have found more efficient means of finishing by drawing on our bank of "Know How."
The Rotary Automatic illustrated represents one of our many types and sizes of automatic finishing machines for either continuous rotation or indexing. The head and stand units shown are a part of a large "family" which range in type and size up to 20 HP.
SEND SAMPLES and we will show you how much you can speed up production and cut costs.
Hammond Machinery Builders INC
1601 DOUGLAS AVE. • KALAMAZOO, MICH.
See us at the ASTE Show, Detroit, Booth 1027, April 21-28

Saporito Opens Custom Plating Plant

A totally new custom plating plant, stated by *C. J. Saporito*, president, to be the largest in the area, has been put into operation by the *C. J. Saporito Plating Co.*, at 1803 S. Fifty-fifth Ave., Chicago 50, Ill.

Precious metal finishing such as gold, silver, palladium, rhodium, and others, to meet the rigid government specifications for nuclear and electronic equipment parts, is done in a separate department under close laboratory control.

For mass production customers, there have been installed continuous process, highly automated platers, including a patented hard coat, aluminum anodizing process developed by the company.

Landsman Joins Fusite

Hal Landsman, formerly head of finishing department of Bruner-Ritter Inc. of Bridgeport, Conn., has joined *The Fusite Corp.* of Cincinnati, Ohio, in the same capacity.

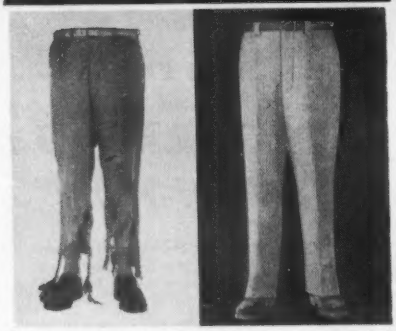
Hal is a member of the American Electroplaters' Society. He attended New York University and Bridgeport University.

Delavan Names Tate

Gilbert H. Tate has been appointed as sales engineer for *Delavan Mfg. Co.*, West Des Moines, Iowa. He will be calling on manufacturing plants in

Gilbert H. Tate

STILL BUYING COTTON or WOOL WORK CLOTHES?



Cotton work pants after less than one week under corrosive conditions.

Worklon pants of 100% Dacron after months of wear under same corrosive conditions.

Are you still watching your profits being eaten away by acids and corrosive chemicals? Why not switch to WORKLON **acid- and caustic-resistant** industrial apparel! **Save** as hundreds of plants and laboratories are now doing...yes, save up to 93% with WORKLON garments of 100% **Dacron*** and 100% **Dynel.**

A variety of **lint-free** and **static-free** acid-resistant styles to meet your every requirement. Read complete details in the new Worklon catalog just off the press. **New lower prices ... larger selection** of garments for both MEN and WOMEN. Send coupon for your **free** copy now!

Quality Fabrics by

TRAVIS®

Fabrics, Inc.,

leading specialists in the development of unique constructions and blends for the specific needs of modern industry.

*DuPont's reg. t.m. for its polyester fiber.

WORKLON

ACID-RESISTANT INDUSTRIAL APPAREL

Worklon, Inc., Dept. MF-30
253 West 28th St., New York 1, N.Y.
Kindly send free Worklon catalog

name.....

co. name.....

address.....

city.....zone.....state.....

Michigan, Illinois, Wisconsin, Northern Indiana.

Mr. Tate was formerly with Wm. A. DaLee, Inc., of Detroit, Mich. His home and business address will be 33043 Anita Drive, Garden City, Mich.

Polymer Corporation Forms Two New Divisions

The *Polymer Corporation* has announced the formation of two new divisions, designed to provide separate identity for the company's extensive sales development and service engineering for its new coating system and new basic resins. *Douglas L. Cochran* will head the Whirlclad Division as general manager, and *Thomas E. Powers* will be sales manager of the Molding Resins Division.

The Whirlclad Division will assume all the activities of National Polymer Products, Inc., now being discontinued as an active subsidiary of the company, which are related to the Whirlclad coating system and to the manufacture and sale of Corvel fusion bond finishes.

Catalytic Combustion Corp. Promotes James L. Donahue

Catalytic Combustion Corp. of Detroit, Mich. announces the appointment of *James L. Donahue* as general manager of its expanding sales department.

Mr. Donahue has been assistant sales manager, responsible for distribution of the company's products in the chemical process industries, with prior experience in the firm's engineering and research departments. Mr. Donahue, a native Detroiter, is a graduate of the Lawrence Institute of Technology.

Sales Mgr. Appointed by United Electric Controls

George W. Clapp of Canton, Mass. has been promoted to sales manager of *United Electric Controls Co.*, Watertown, Mass.

Mr. Clapp has been with the company since 1951, and was formerly a sales engineer and account manager for the nation-wide manufacturer of temperature and pressure controls prior to his selection as sales manager. Originally from Quincy, Mass., Mr. Clapp saw military service in France and Germany during World War II. He is a graduate of the University of Miami engineering college.

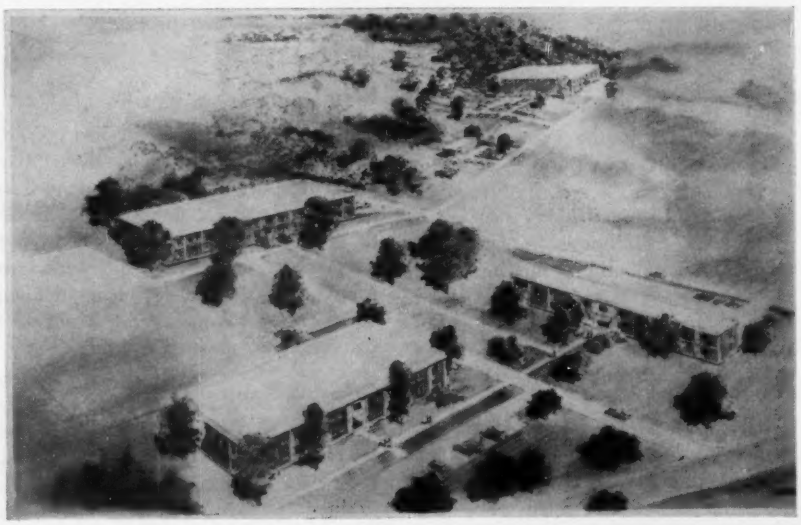
Chainveyor Appoints Distributor

Chainveyor Corp. has announced the appointment of *Mizi Co., Inc.* as the exclusive distributor for overhead powered and power-free conveyor systems for the state of North Carolina.

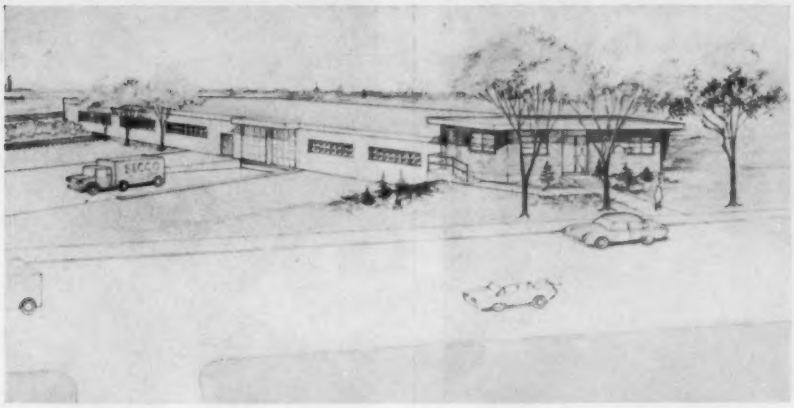
Pennsalt Chemicals to Build Technical Center

Pennsalt Chemicals Corp. has concluded negotiations to purchase a 50-acre site in the King of Prussia Park for construction of a technical center which will ultimately represent an investment of $6,000,000. The park is located at the Valley Forge Interchange of the Pennsylvania Turnpike.

Plans call for a campus-type arrangement featuring a central mall. The first building in the complex will be a two-story laboratory occupying approximately 21,000 square feet. Construction will start early in 1960 and will be completed before the end of the year.



Becco Starts Construction of New Distributing Center



Construction has begun in Lyndhurst, N. J., on a new distributing center for the Becco Chem. Div. of *Food Machinery and Chem. Corp.*, whose headquarters and principal production plant are in Buffalo, N. Y. The center, which is expected to be completed by May 1, 1960, will replace the present center in Jersey City, whch was established in 1929. It will provide larger and more efficient storage and distribution facilities for the company's products.

The new center will receive bulk shipments of hydrogen peroxide and other peroxygen chemicals from the main production plant in Buffalo, and will distribute these in smaller quantities to customers in this area. Deliveries will be made in tank trucks, drums, or carboys, in the quantities and concentrations best suited to the particular requirements of the customer.

Carborundum Announces Appointments

The *Carborundum Co.'s* Bonded Abrasives Division has announced the following appointments:

H. B. Jorgensen — formerly salesman in the Chicago district, is appointed supervisor, sales training section, reporting to the sales manager and assistant sales manager, at Niagara Falls.

M. F. Jenkins — formerly salesman in the central Indiana territory, is appointed field sales engineer in that area.

H. Porth — formerly salesman in the Rockford, Ill. area, is appointed salesman in a new Indianapolis territory.

R. R. Kerrigan — formerly sales trainee, is appointed to succeed Mr. Porth in the Rockford, Ill. territory.

K. W. Martin — formerly a salesman in the Buffalo territory, is appointed salesman in the Syracuse territory replacing *P. R. Junod*, who was promoted to the position of district sales manager, Philadelphia district.

W. W. Spiller — formerly sales trainee, is appointed salesman in the Buffalo territory succeeding Mr. Martin.

J. H. Jones — formerly salesman in the San Diego-Arizona territory, is appointed salesman in a new Arizona general territory.

G. S. Schroyer — formerly sales trainee, is appointed salesman in the Salt Lake City territory replacing *E. A. Japely* who was promoted to the position of district sales manager, Area A, of the Chicago district.

New Grieve-Hendry Plant

Grieve-Hendry Co., Inc., industrial and laboratory oven and furnace manufacturers, have moved to modern, new sales and production quarters at 1350 N. Elston Ave., Chicago 22, Ill.

Increased production space allows the manufacturer to fabricate virtually any type of heat processing equipment required by industry. The addition of new production equipment and the development of material flow patterns assure maximum manufacturing efficiency, resulting in vastly improved delivery. Engineering, production and office personnel have been added.

As in the former plant, facilities have been provided to factory test each oven before shipment. The move coincides with the firm's tenth anniversary and culminates a series of expansion developments for the rapidly growing manufacturer of heat processing equipment.

Luster-on

ECONOMICAL PROTECTIVE COATINGS FOR BRASS, ZINC, CADMIUM, COPPER, ALUMINUM

The Chemical Corporation offers a complete line of uniform-controlled chromate conversion coatings that provide maximum protection in one, low-cost, simple operation. Available for immediate delivery as liquid or powder.

Always Specify Luster-on —

FOR BRILLIANT CORROSION-RESISTANT FINISHES . . . rivaling chrome for many applications where cost is a factor. Long-lasting, easily controlled application.

FOR CLEAR, BRIGHT and IRIDESCENT COATINGS . . . gives striking, attractive appearance with complete corrosion-protection . . . even when humidity and handling are involved during processing. Also yellow iridescent and olive drab for concealed parts or as a paint bond.

FOR DECORATIVE COLOR . . . on low-cost zinc. Brilliant golds, yellows, blues, greens, violets, reds, brass and copper hues.

FOR ALUMINUM . . . where surface hardness is not of prime importance. Excellent finish for paint bonding.

FOR LASTING BRIGHTNESS . . . on both copper and brass without noxious fuming.

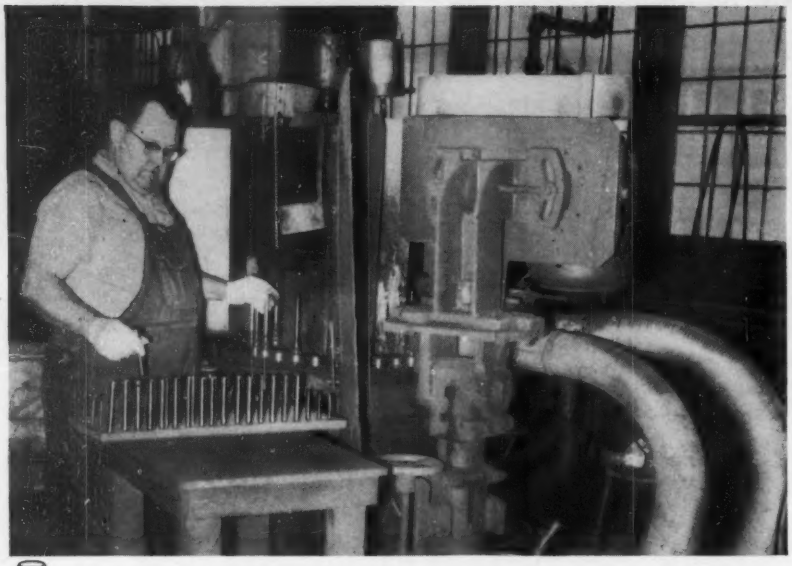
FOR DIE-CASTINGS . . . one quick dip provides uniform finish, ideal as a base for painting.

We'd like to show you what Luster-on can offer you! Send in sample part today for free processing. Data sheets on request.

Luster-on . . . the first and still the finest in conversion coatings.

The Chemical Corporation

58 Waltham Ave., Springfield 9, Mass.



a mere 5 million flashlights old...

Purchased by Ray-O-Vac for use at their Clinton, Mass. plant in 1956, this Model 4-28 Packer-Matic has been producing high luster finishes on flashlight cases at the rate of 900 per hour . . . 8 hours each day . . . 200 days every year . . . steadily and successfully without downtime for costly repairs or maintenance. Yet it is still a "newcomer" at Ray-O-Vac.

The picture shows operator Thomas Baird loading Ray-O-Vac Pen-Lite cases, one of the smaller tubes this versatile spindle automatic handles. Tom regularly uses 5 other sets of tooling developed for the wide variety of flashlight cases Ray-O-Vac manufactures.

"Best thing I can say about our 8 Packer-Matics, reports Mr. R. M. Goodwin, Ray-O-Vac Plant Manager is that we've used them since 1934 and they've never let us down. We can always count on our Packer-Matics to make production."

You can, too. Send us samples of your parts, specifications or blueprints. Polishing, deburring or cleaning.

Production reliability makes Packer-Matic the choice of companies like

RAY-O-VAC COMPANY

PACKER-MATIC

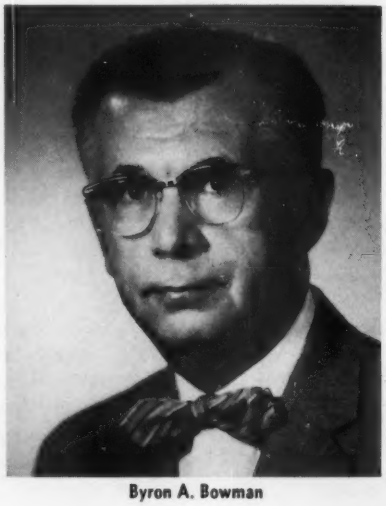
THE PACKER MACHINE COMPANY • MERIDEN, CONN.

Pioneer Manufacturers of Automatic Polishing & Buffing Machines

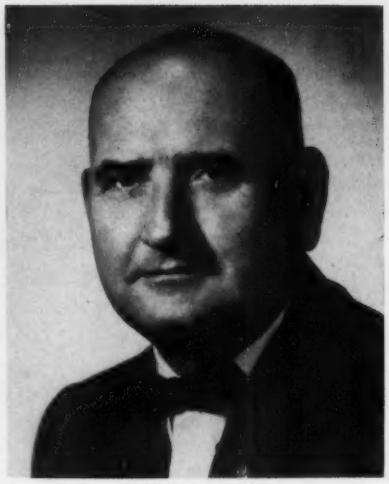
Changes at K & F Metal Finishers

K & F Metal Finishers, Inc., Dayton, Ohio, has announced the appointment of *Byron A. Bowman* to plant manager and the transfer of *Ralph G. Dearth* to the sales department.

Mr. Bowman is a graduate of Defiance College, Defiance, Ohio, and has had one year of post graduate work in chemical engineering at Ohio State University. During the past 18 years he has been involved in research, development and production work at Aeroproducts-Allison, Division of General Motors, where he was supervisor of the Engineering Process and Standards Department. Mr. Bowman has had



Byron A. Bowman



Ralph G. Dearth

experience in metal finishing, plating, painting, adhesives, brazing, corrosion study, radiography and packaging. The new plant manager is now first vice president of the Dayton Branch of the A.E.S. and has published some articles of technical nature.

Mr. Dearth has had more than 30 years experience in the plating field, which includes some 19 years with General Motors. His last 13 years have been with K & F. Mr. Dearth's wide area of experience and contact with many people in industry well qualifies him in assisting customers in the sales field.

Porter Appoints Paint Sales Manager

H. K. Porter Co., Inc., diversified Pittsburgh-based industrial manufacturing concern, has appointed *Elmer Balogh* as general sales manager of the *Patterson-Sargent Co.*, new Cleveland, Ohio, subsidiary.

Balogh, 36, is a Clevelander and has been associated with The Sherwin-Williams Co., for the past twelve years. He was most recently sales manager of the Graphic Arts Sales Division. He is a graduate of Miami University, Oxford, Ohio, with a B.S. in Business Administration.

Dr. George C. Harrison, Jr. Joins Amchem

Dr. George C. Harrison, Jr., who resigned from the Pennsalt Chemicals Corp., Philadelphia, shortly before the first of this year, recently joined *Amchem Products, Inc.*, Ambler, Pa. He was engaged in the study of complex organic and inorganic compounds at Pennsalt's Whitemarsh Research Labo-

Dr. George C. Harrison, Jr.

ratories. At Amchem, he is specializing in protective coatings for steel in the Metalworking Chemicals Division.

Dr. Harrison was graduated from the University of Pittsburgh, in 1951, with a degree in chemistry. He received his doctorate, in inorganic and physical chemistry from the same university, in 1956.

Courses on Industrial Wastes

Consecutive courses on industrial wastes will be offered through most of May by the Water Supply and Pollution Control unit of Training Program, Robert A. Taft Sanitary Engineering Center, PHS, Cincinnati, Ohio.

Graduate chemists and other scientists with backgrounds in water supply and pollution control may enroll for "Organic Industrial Wastes Characterization," May 9-20; "Inorganic Industrial Wastes Characterization," May 23-27, or both courses. No registration, tuition, or other fees are charged for the courses, and text manuals are provided.

Extensive laboratory work and detailed consideration of applications of methods toward the ultimate production of usable water will be emphasized in both courses.

Applications should be addressed to Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office Director.

Pangborn Forms Vibratory Finishing Division

Pangborn Corp., Hagerstown, Md. has announced the establishment of a new Vibratory Finishing Division. The new corporate division, located at the company's Hagerstown headquarters, is headed by *William E. Brandt* who has been appointed a division manager. Mr. Brandt is a widely known authority on precision finishing.

William E. Brandt

To launch its new division the firm has designed a new line of finishing machines and will soon announce details on exclusive features said to effect significant improvements.

In addition, the company is now marketing a full line of precision barrel finishing and vibratory finishing media and compounds.

- Carefully-controlled standards of purity and uniformity
- Orders filled promptly
- Material easy to handle in sacks and fiberboard drums

PHELPS DODGE REFINING CORP.
300 PARK AVENUE, NEW YORK 22, N. Y.

Platzman Forms New Ultrasonic Company

Paul Martin Platzman, New York industrialist and leading authority in the field of ultrasonics, has announced the formation of *Ultrasonic Industries, Inc.* The new organization has acquired a temporary 5,000 sq. ft. modern facility at 141 Albertson Ave., Albertson, L. I., for its immediate administrative and manufacturing needs. A lease-purchase agreement has been signed by the company for two acres of property in the Engineer's Hill section of the Plainview Industrial Park. The company plans to occupy a 36,000 sq. ft. building to be constructed on this site in 1960.

Joining Mr. Platzman and filling key positions are *Herbert A. Frankel*, vice president-sales; *Harold S. Remz*, vice president - engineering; *Charles F. Combs*, treasurer; *Barbara A. Jewett*, secretary (all formerly of The Narda Ultrasonics Corp.) and *John P. Drinjak*, manager of manufacturing, formerly of Acoustica Associates, Inc.

The firm will place major emphasis on aggressive nation-wide marketing through regional factory sales offices and distributors served by a manufacturing facility capable of high production rates.

Chase Buff in New Location

Chase Buff Co., manufacturer of muslin and sisal buffs, announces that it has moved to new quarters at 152 MacQuesten Parkway So., Mt. Vernon, N. Y., telephone FAirbanks 4-7570.

News from California

By Fred A. Herr

After 37 years with the Price-Pfister Co. of Los Angeles, during the last 20 years of which he served as plating department supervisor, *Paul Franke* retired January 1. Plating department supervision at Price-Pfister is now directed by *Leroy Churchdown* as day foreman and *Ned Robinson* at night.

Though retired from direct supervision of the firm's plating operations, Paul will serve as on-call consultant to the new regime. He plans to devote his retirement to pursuit of his hobby of gardening at his home at 1268 67th Ave., Los Angeles, and to "some comfortable resting" at a cabin he owns near Newhall, Calif., in the mountains north of Los Angeles.

Atwood Plating, a division of Atwood Machinery Co., Vernon, Calif., recently moved into a new 12,000 sq. ft. plant at 2124 E. 51st St., Vernon, a Los Angeles industrial suburb. The enlarged plant has been equipped with a new major hard anodizing set-up and facilities for electroless nickel and precision hard chromium plating. A new department has been equipped for application of solid film lubricants.

U. S. Borax & Chem. Co. has announced appointment of *William J. Dibble* as director of marketing, with headquarters in Los Angeles. Dibble was formerly assistant in the marketing division which directs sales and distribution of borax and potash products. He joined the firm in 1955 after several years service as manager of the detergent products department of Oronite Chem. Co., San Francisco.

Robert O. Johnson has been appointed manager of the new western regional office established in Palo Alto, Calif., by Consolidated Vacuum Corp., of Rochester, N. Y., a subsidiary of Consolidated Electrodynamics Corp. Johnson will supervise the firm's activities in the Pacific Coast, Rocky Mountain and Southwest states. He has been with the company since 1948 as a vacuum technician, service engineer, sales engineer and manager at Palo Alto.

Oronite Chem. Co. of San Francisco has started construction on a multi-million dollar plant at Richmond, Calif., for the manufacture of maleic anhydride, a chemical intermediate used in the production of plastics, paints, and wetting agents.

The new plant will have a capacity of 20 million pounds per year and is reported to be the first installation of its type in the West. Completion is expected by mid-summer of 1960.

The Spring semester of evening courses in paint technology began February 1 at Los Angeles City College. The courses are being offered in cooperation with the Los Angeles Paint & Varnish Production Club and the Los Angeles Paint, Varnish & Lacquer Association for employees of the paint industry and other qualified persons.

The subject of varnishes and synthetic resins is treated in two unit courses. Phenolic, maleic and ester gum varnishes are given special study, and the course also covers alkyd resins for air dry and baked finishes and other resins, such as urea, melamine and silicone. The second unit pertains to Paint Technology 12. *Roy Fredericks* is the lecturer.

Also offered is a course entitled "Enamels and Varnishes Laboratory" which is designed for students enrolled in Paint Technology 22. The instructor is *Fred L. Fox.*

Announcement has been made of the

LAST CALL FOR SPECIAL LOS ANGELES TRAIN

Due to the lead time required by the Erie and Santa Fe railroads to work out the details and ticketing for the Metal Finishing Special Train, it is absolutely essential that all those interested write to us by April 1st. A total of one hundred first class adult fares are required to operate the special train from Chicago to Los Angeles.

As planned, the Convention Train will leave from the Dearborn station, Chicago, on Thursday, July 21st, reaching Los Angeles Sunday morning, July 24th. All day Saturday, July 23rd will be spent at the Grand Canyon, with no additional charge except for meals. If there is sufficient interest, one or more sleeping cars out of Hoboken, N. J. one day earlier will be attached to the Special.

A schedule of fares will be found on page 34 of our February issue or page 23 of January, which includes a family plan with lower rates for wives and children. Return may be made from Los Angeles on any direct railroad or via Canada at a slight additional charge.

If you are interested in taking this train to the A.E.S. Convention, write us at once sending your name, address and number in the party. Address: Los Angeles Convention Train c/o Metal Finishing, 381 Broadway, Westwood, N. J.

purchase by Metal Control Laboratories, Inc., Huntington Park, Calif., of Pacific Testing Laboratories, Inc. of Van Nuys, Calif. The latter is a firm specializing in fatigue testing and research. Facilities and personnel of Pacific Testing have been moved to the headquarters of Metal Control Laboratories in Huntington Park.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Phoenix Branch

The first Arizona Metal Finishing Symposium and Industrial Exhibition will be held at Arizona State University on Saturday, March 26, 1960. The technical sessions will cover modern finishing procedures, techniques and processes, and the exhibits will have interesting displays by the many facilities throughout the state.

Further information may be had by contacting *Paul Wible*, general chairman, at 3622 E. Sheridan, Phoenix, Ariz.

Milwaukee Branch

The annual Educational Session and Banquet will be held on Saturday, April 30, 1960 at the Hotel Schroeder.

Following the 12 Noon luncheon will be the technical session at 1:15 P.M., with *Lloyd Gilbert* of the Rock Island Arsenal as speaker. After his talk a work session will be held on finishing problems. The banquet and entertainment are at 7:00 P.M.

Tickets may be purchased by contacting *Fred Anderson*, S. K. Williams Co., 2370 N. 32nd St., Milwaukee 10, Wisc.

Waterbury Branch

The branch had its annual Sustaining Members Night on January 14, at the Hotel Roger Smith. Representatives of ten of the branch's sustaining members and two prospective sustaining members were present. A short business meeting was held before the introduction of the evening's speaker. *Frederick DePalma* and *Samuel Longo* received membership certificates. *Jim Kennedy* reported that the first book had been donated to the branch for presentation to the local library as part of a program to furnish it with a complete collection of technical books related to metal finishing.

Ray Mitchell, technical chairman, introduced the speaker, *Dr. D. Gardner Foulke*, who spoke on "The AES Research Program." Foulke described the program from its inception, outlining the major projects and contributions of the program. He gave those present an up-to-date report on current projects and explained to the sustaining members present just how their contributions were spent and the value they were getting for their dollar.

F. A. Schneiders
Publicity

Columbus Branch

The monthly meeting was held on January 8 at Battelle Memorial Institute. The business meeting included a discussion of the Tri-State Meeting to be held in Columbus in 1961, and the election of a new member, *Myles Drake* of Detrex Chemical Co.

Librarian *Hugh Miller* introduced the speaker of the evening, *Dr. Alvin S. Winger* of Rohm and Haas Co., Philadelphia, Pa., who spoke on "The Application of Ion-Exchange to Plating Problems." Dr. Winger presented an excellent account of successful applications of ion-exchange to waste disposal, metal recovery, and bath treatment. His treatment of the stability of resins, the so-called poisoning of resins by some salts, and the economics of their use added much to the value of his talk. In the question period which followed, Dr. Winger commented on the status of permselective membranes as regards their manufacture and industrial use.

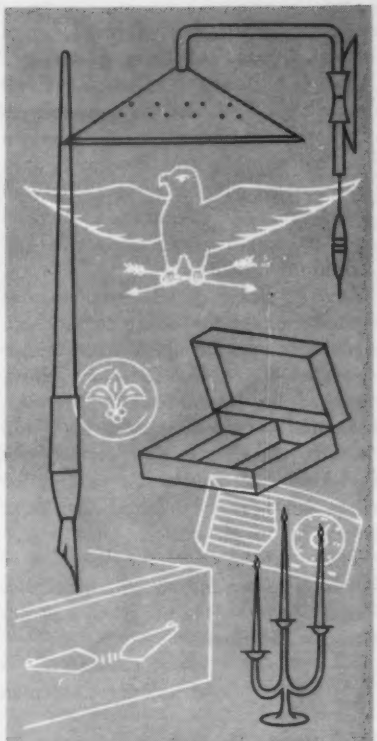
The meeting was adjourned following an interesting movie on basic electricity done in cartoon-style by Walt Disney Studios. Refreshments were served following the meeting.

L. McGraw
Secretary

Dayton Branch

The 14th Annual Educational Session and Dinner Dance will be held on Saturday, March 5, at the Dayton Biltmore Hotel. *Byron Bowman* is general chairman, assisted by *Larry Hadlock*, co-chairman.

The educational session, under the direction of *Robert Fisher*, educational chairman, will begin promptly at 1 P.M. with *Ralph D. Wysong*, Supreme Society President, as honorary chairman. The speakers and their topics



FOR TARNISH-PROOF BRILLIANT GOLD, BRASS, AND BRONZE FINISHES

Nacromer®
SYNTHETIC PEARL ESSENCE

To achieve new brilliance for your metallics, apply a Nacromer top coat over the suitable mixture of yellow, green, red, and brown pigments. Nacromer changes the character of these otherwise garish finishes... making them rich-looking with a soft distinctive glow. And, the use of Nacromer in this way, makes the metallic finish tarnish-proof.

Whether you use Nacromer for metallic or other decorative effects, you'll find that Nacromer is a low-cost way to add character to ordinary coatings. It is compatible with most coating vehicles and can be applied to almost any material by the usual coating methods. Try it, and see how it makes your product more distinctive.

FREE 8-PAGE HANDBOOK

This valuable guide to the use of natural pearl essence and synthetic pearl pigments is yours for the asking.

THE MEARL CORPORATION
world's leading producers of pearl essence
41 EAST 42nd STREET • NEW YORK 17, N.Y.

will be: *Christopher Marzano*, chief chemist, Amphenol Borg Electronics Corp. — "How to Plate Difficult Metals"; *B. F. Lewis*, technical director, Northwest Chem. Co., — "Modern Metal Cleaning"; and *Walter L. Pinner*, manager plating service, McGean Chem. Co., — "Preparation of Steel for Electroplating and Copper-Nickel-Chromium Coatings."

Jack V. Baker, hotel chairman, has announced that the doors to the ballroom will open at 6:15 with dinner scheduled for 6:45. The floor show, arranged by *R. L. Ruleff*, entertainment chairman, will start at 8:15, followed by dancing to the music of the Karl Taylor Orchestra. Favors for the ladies have been selected by *John Myers*, favors chairman.

Ticket sale is under the direction of *Duanne Prosser* and his committee and *Walter Anderson* is program and advertising chairman.

L. A. Critchfield
Publicity Chairman

Blue Ridge Branch

The branch met January 8 at the Polo Grill in Winston-Salem, N. C., *Dr. Nelson F. Murphy*, presiding. New memberships were announced for *Herbert M. Cole* of Brame Textile and *Roger G. Stevens* of Grant Chemical, both in Greensboro, N. C. *Henry Strow* delivered a most educational and practical discussion on brass plating. To hear the Yankee brass plating authority, 31 people poured in from Blacksburg, Va.; High Point, Winston-Salem, Greensboro, Statesville, Charlotte, and Mount Airy, N. C.; and other guests were from St. Petersburg, Fla. and Stratford, Conn. Enthusiasm was electric as members and guests fed questions to the speaker and the speaker responded as rapidly as the next question came in — it was a real Blue Ridge Type meeting. It was announced that the branch will meet in Greensboro February 5, to hear a speaker from Interchemical on Organic Finishing and another plant tour is planned in March for Sperry-Farragut in Bristol, Tenn.

Robert H. Probert
Secretary

British Columbia Branch

A general meeting was held at the Loughheed Hotel, Loughheed Highway, North Burnaby, B.S., on Wednesday, January 27th, with 17 members and guests present. Following cocktails and dinner, the meeting opened at 8:30 p.m. with President *Nelson Shepherd* in the chair, who welcomed members and guests to the first meeting for 1960.

Walter Kellerman gave a brief report on the night school course, which is now in the second half and, to date, all but 4 students are still attending regularly. There are 22 students. Mr. Kellerman referred to a list of equipment which is required by the night school authorities, in order to assess the value of keeping the course going through the next term. *W. Marquardt* then moved that a committee be set up, consisting of 3 or 4 members, including the instructor, Mr. Kellerman, as chairman, to investigate costs and submit a list to the Night School Authorities, and the general membership of the Branch. The committee appointed for this are *W. Marquardt, C. Schlossareck*, and *R. Wolloschuk*. A committee of 3 was appointed to act as an educational committee until the end of this year, to look after the interests of the A.E.S. in connection with the current night school course, with powers to report only. The committee consists of *G. Smith, T. Wallington*, and *W. Kellerman*.

The secretary asked delegates to the Los Angeles Convention for information as to who will be attending. The following are the names of delegates who will attend, and the secretary will advise the executive secretary immediately: *T. Wallington, W. Kellerman, N. Shepherd*, and *W. Kilby*.

D. Armstrong
Secretary

Buffalo Branch

The branch held its January 8th meetings at the Niagara Manor in Buffalo, N. Y. with 25 in attendance. *Daniel Stachowiak* of the Sylvania Electronics Division, Buffalo, N. Y., was elected to membership. *Harold Shapiro* introduced one guest and reported on the changes in branch membership since September. *George Wolf*, representative to the Technical Societies' Council of the Niagara Frontier, reported that the Annual Science Fair will be held April 19-21 at the Memorial Auditorium in Buffalo, N. Y. The branch voted to sponsor a booth at the fair with the hopes of stimulating interest in AES membership. Mr. Shapiro was appointed chairman of the committee and will be assisted by *George Wolf* and *Paul Conn*.

Ray Kilroy announced that *Wally Keefe* of the Jamestown area is confined to the hospital due to a coronary attack. The Christmas Party Committee, *Chuck Fotheringham*, chairman, *Roger Brown, Bob Eich* and *John Tiebor* were given a rising vote of thanks for staging a wonderful party.

After the business session, Librarian *Dick Davis* introduced the speaker of the evening, *Clarence Sample* of the International Nickel Co., whose subject was "Corrosion Behavior and Protective Value of Electrodeposited Coatings."

King Ruhly, sales manager of the

DEPENDABLE PPI PRODUCTS

RUBBER AND PLASTIC DRUM LINERS
MONEL, STEEL, COPPER AND TITANIUM ANODE HOOKS
PLASTIC COATED PAILS AND DIPPERS
POLYETHYLENE TANKS AND PAILS
TITANIUM ANODE SCRAP SAVER BASKETS
TITANIUM HEATING COILS
TRICHLOROETHYLENE
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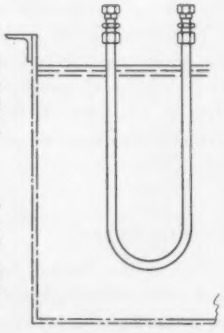

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KOKOMO, INDIANA

Michigan Chrome & Chemical Co., will speak at the April 1st meeting on "Electroplating, Rack Coating and Stop-Off Materials."

Robert E. Lienert
Secretary

Newark Branch

The January 15th meeting was called to order by President Meyer who appointed a nominating committee consisting of *Gus Bittrich*, chairman, along with *Robert Ehrardt* and *Tim Austin*. One application was accepted and *Maurice Rand* of Ethicon, Inc., was elected to membership. *Cy LaManna* reported that the Electroplating School would begin early in February and that no further registration could be accepted. The New York and Philadelphia Annual Meetings were announced and Newark members were urged to attend. *Tom Menzel*, Newark's Florida member, and *Ed Washburn*, past officer of the branch, were introduced.

Don Foulke, substitution for *Al Korbelak*, who was attending the Dixie Regional Meeting, introduced *Mario DiChiara* of Royal Plating and Polishing Co., who discussed "Color Anodizing." Mario reviewed the anodizing baths available, cycles for color anodizing were given, and some of the problems encountered were outlined. Samples were submitted for inspection.

William Murray, marketing manager of Enthone, Inc., presented "Plating in Action." By means of plastic cells through which light was passed, various electrode reactions were projected on the screen with the help of Ed Washburn. After an extended question-and-answer period, a rising vote of thanks was given both speakers.

D. Gardner Foulke
Secretary

Los Angeles Branch

The plant visitation sub-committee of the National Convention Committee met January 13 at Rodger Young Auditorium, preceding the branch's monthly business session and educational program to map plans for plant visits to be programed as part of the 1960 AES convention in Los Angeles in June.

Committee Chairman *Harvey K. Hunt*, and past-presidents *Truman Stoner* and *George Magurean*, evaluated various suggestions designed to provide convention visitors with an entertaining as well as informative series of trips to plating installations as well as to other industries typical of Southern California.

Tentative consideration was given by the committee to suggestions that the visitation program include such typical California industries as a citrus packing and orange juice production plant, a winery, and possibly a pottery plant. Individual committee members were delegated to investigate the possibilities of arranging such trips.

Consideration was given to the possibility of including a visit to a motion picture studio. Discussion revealed that current policy at most film studios is not to make arrangements for such visits directly with convention committees but to have all such group visits arranged through Tanner Motor Tours, a chartered bus company. The committee was advised that the cost, under such conditions, would be so high that it is probable no A.E.S. sponsored studio trips will be arranged. Convention delegates wishing to visit a film studio will be required to make their own arrangements.

The business session of the January 13 meeting was attended by 85 members and guests. First vice president *Frank Virgil* presided. Four applications for membership were submitted and referred to the board of managers for screening.

Guests present at the meeting included *Walter H. Walczyk*, western sales representative of Sel-Rex Corp. of Nutley, N. J.; *D. E. Goggin* and *Jack Cheney* of Roketdyne, Inc.; and *Daniel Ross* of MacDermid, Inc.

The chair appointed a nominating committee consisting of *Larry O'Neil*, (chairman), and past-presidents *E. Stuart Krentel* and *Truman Stoner*. The committee will contact and screen potential candidates, select a recommended slate of officers, and submit it to the general membership on election night, March 9. Under the branch's by-laws, any member also is privileged to submit a name or names of candidates to the committee, or make his nominations from the floor on the night of election. The 1960 president of Los Angeles Branch will have the additional distinction of serving as host-president for the 1960 A.E.S. convention to be held this coming July in Los Angeles.

The speaker at the January 13 tech-

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WELDED CONSTRUCTION — Note how welds have dissolved or broken in use. Often caused in barrel plating where currents are high and barrel transfer is rapid.

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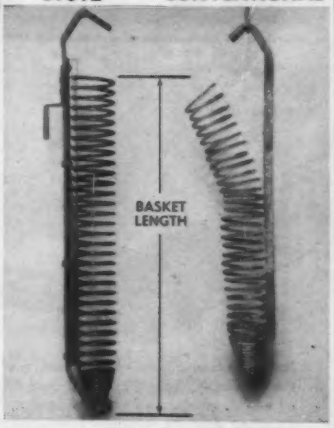

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nical session was *William F. Seyer*, professor of engineering at the University of California at Los Angeles. Professor Seyer, one of the leading American authorities on corrosion, gave a talk on "Physical-Chemical Aspects of Corrosion Processes."

With slides, the speaker illustrated such phases of his lecture as hydraulic analysis of anodic and cathodic polarization, the electronic approach to metallic corrosion, the anode and cathode relation on copper-plated metal parts, and oxygen combinations that produce oxidation and corrosion.

Indianapolis Branch

The year 1960 started off with a good attendance at the January 5th meeting, when 52 were present for the dinner and four more for the meeting. *Les Reynolds* presided and asked for introductions. At this meeting was one member who was founder and first president of the Branch, *Walter Binai*. A hearty round of applause was extended to him.

L. J. Howald of the Cincinnati Branch reported on the Tri-State meeting, which will be on April 23rd at Cincinnati. There will be morning and afternoon educational sessions with a variety of topics to appeal to management, shop personnel and others. The ladies are to be entertained by a fine program.

Under new business, nine new members were voted into the society: *Kenneth Walker, Joseph L. Braune, George Smolens, Harry D. Moore, Joseph C. Cotton, L. Cecil Reeder, Faris W. Boston, Fred E. Thornburn* and *Ralph Teter*.

The third sustaining member was announced, Guide Lamp Division of General Motors of Anderson. A letter was read by the secretary introducing *Robert Garard* of the Springfield Branch as candidate for third vice president of the national society.

Mark Trook, librarian, introduced the speaker of the evening, *Dr. M. M. Beckwith* of Harshaw Chemical Co., who is one of the branch's own members. The topic was "Studies of Duplex Nickel Plating." Dr. Beckwith gave the background of nickel finishing and testing, especially for the last 10 years. Many interesting facts were presented and slides were shown to show just how the tests are made.

Edna Rohrabaugh
Secretary

St. Louis Branch

The regular monthly meeting was held January 13th at the York Hotel with 23 members and guests present for dinner. There were 30 members and guests when the business meeting was called to order by President *William Piel*. Everyone stood and introduced himself and gave his company affiliation. The minutes of the previous meeting were read and a correction made to read that three men who attended the December meeting had read the meeting announcement in the Post Dispatch daily evening paper. *Louis Berra*, treasurer, was absent so there wasn't any treasurer's report. There were no applications for membership.

A letter was received from Headquarters relative to increase in membership with men 1) having a serious personal interest in electroplating, metal finishing and allied arts, 2) having a thirst for educational enrichment in the arts and sciences of that field,

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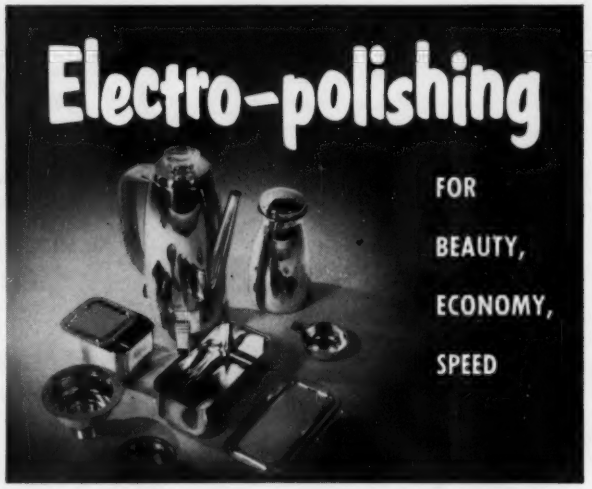

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3) having deep desire to join and become lastingly assimilated by an AES Branch and, 4) having the character and personality to "fit" and "belong" in such a Branch.

A letter from *Robert M. Norton*, chairman Public Relations Committee, was relative to more appealing and attractive monthly educational sessions, to publicize them even more effectively, to draw larger attendance.

A letter from *Palmer H. Langdon*, publisher METAL FINISHING, called attention to the special train from Chicago to Los Angeles and asked if there would be sufficient interest.

The correspondence was turned over to committees for action. Unfinished business consisted of the delegates beminded that they were to select a member whose deeds warrant consideration for the *Charles Henry Proctor* Memorial Leadership Award, and a report by *Andy Julius* that the exposition site would not be decided until the March interim meeting. There was no new business so the meeting was turned over to Librarian *Richard Gotsch*, who introduced the speaker of the evening, *James A. Viola*, of Rapid Electric Co., Bronx, N. Y. His talk was on Selenium, Germanium, and Silicon Rectification in the Plating Industry and Related Controls. The talk was illustrated by blackboard diagrams. Much interest was created and a very active question and answer period followed. The meeting was adjourned with a rising vote of thanks to Mr. Viola for his interesting talk.

Ward Kelly
Secretary

Cincinnati to Host Tri-State Regional Meeting in April

An expanded educational session will highlight the Sixth Annual Tri-State Meeting of the A.E.S. Morning and afternoon sessions will be a new feature for this meeting which will be held on Saturday, April 23, at the Sheraton-Gibson Hotel in Cincinnati.

The interesting educational program planned is expected to bring out more operating and technical personnel than have attended any previous Tri-State meeting, according to *Lee J. Howald*, Harshaw Chemical Co., general chairman. "Anyone who attends this meeting seriously intending to increase his knowledge of plating, will leave the meeting satisfied," Mr. Howald commented.

David L. Kaplan, Electric Auto-Lite Co., is chairman of the committee planning the educational sessions. *Ralph D. Wysong*, Studebaker-Packard Corp., president of the A.E.S., will be Honorary Chairman. Mr. Kaplan reports that his plans are almost complete, with the program including five speakers:

1. 11:30 A.M. *Personnel in Plating*, by *Robert L. Giesel*, president, Adolph Plating, Inc., Chicago. Mr. Giesel will show the testing procedures his large job plating shop employs for selecting employees. He will also describe his company's plan for motivating employees.

2. 12:10 P.M. *Corrosion Resistance of Decorative Plates*, by *James D. Thomas*, senior research engineer on electroplating research, General Motors Research Laboratories, Detroit. Mr. Thomas will discuss the research program sponsored by the A.E.S., which is producing information of value in improving corrosion resistance of decorative electroplates. Results of outdoor exposure tests by *A.S.T.M. Com-*

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mittee B-8 will be discussed as to their effects on the several variables included in the program. The thinking of the *Society of Automotive Engineers* in writing specifications for plating which put all corrosion tests as a principal consideration and plate thickness as secondary, also will be discussed.

3. 2:00 P.M. *Waste Disposal,* by *George E. Barnes,* consultant and professor of hydraulic and sanitary engineering, Case Institute of Technology. Professors *Barnes* and *Weinberger* will show the work they have done and the methods they have used in setting up and improving waste treatment facilities in the plating industry. Working on the premise that waste destruction is no longer the sole answer to the problem, they have redesigned production facilities to improve quality of the work turned out and to secure more concentrated rinses. From these concentrated rinses, metals and cyanides can be recovered either by direct reclaim of first rinses or by means of such devices as ion-exchange, dialysis, evaporation, or these methods in combination with others. Case histories will be included to illustrate installations of interest to operators of large and small plating shops.

4. 2:40 P.M. To be announced.

5. 3:10 P.M. *A Visit to Moscow,* by *Dr. Abner Brenner,* chief of the Electrodeposition Section, National Bureau of Standards, Washington, D.C. Dr. Brenner will describe his visit to the Soviet Union, where he attended the Conference on Protection and Corrosion of Metals. Most of the talk will be non-technical and will be concerned with Dr. Brenner's general impressions of the Russians and their city. Illustrated with slides.

The Tri-State region of the A.E.S. includes the *Cincinnati, Dayton, Indianapolis, Louisville* and *Columbus* branches, one of which is host each year for the annual meeting.

James D. Thomas

Dr. Abner Brenner

More than 300 platers and suppliers are expected to attend the meeting, which will conclude with an evening cocktail party sponsored by suppliers, and a dinner dance. The ladies will socialize in the hospitality suite hosted by the Cincinnati Branch while their men attend the educational sessions.

Another innovation at this year's meeting will be a special reduced registration fee ($3.00 per person) for those who wish to attend educational sessions only and cannot stay for the evening festivities. The regular registration fee ($9.50 per person) includes everything — educational sessions, banquet and dance.

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UPPER MIDWEST METAL FINISHING ASSOCIATION

The association met on Monday evening, Feb. 1st, at Jax Cafe, 20th & University Ave. N.E. in Mpls. with 34 members and guests in attendance.

The secretary announced four new members, whose applications were considered and accepted at the last board meeting: *Dale Jesky* of KP Mfg. Co., *Richard Thompson* of Thompson Hayward Chemical Co., *Vernon Discher* of Designware Industries, and *Solomon Lederman* of Airmotive Machining & Engr. Co. The new members were given a round of applause and welcomed into the association.

Membership applications were read and the applicants presented to those in attendance at the February meeting with the new applicants being *Bob Severson* of Superior Plating, Inc. and *Ray Sauber* of Oakite Products, with these applications to be considered at the March meeting of the board of directors. The association's membership now stands at 81 members.

1960-1961 membership rosters for the Upper Midwest Metal Finishing Association have been printed and will be forwarded to all members within the next two weeks.

Dr. Dodd S. Carr and *Charles R. DeBevoise*, both of Freeport Nickel Co., New York, N. Y., were introduced to the membership with Mr. Carr presenting a program on, "How to Select for Engineering Applications." Dr. Carr's talk was very well received and he was given a rousing vote of thanks and a small token of appreciation upon the completion of his talk.

Robert L. Buckley
Secretary-Treasurer

INSTITUTE OF METAL FINISHING

The annual Spring Conference will be held April 26-30, 1960 at the Grand Hotel, Scarsborough, England. Information on the papers to be given may be obtained from *S. Wernick*, Honorary Secretary, 32 Great Ormond St., London, W.C. 1, Eng.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

New officers have been elected to head the National Association of Corrosion Engineers for the period beginning March 1960 and ending March, 1961. *George E. Best*, Manufacturing Chemists' Assn., Washington, D. C., will be president. *Edward C. Greco*, senior research chemist of the research department, United Gas Corp., Shreveport, La., is vice president elect and *C. G. Gribble, Jr.*, district manager for Metal Goods Corp., Houston, Texas, will become treasurer.

Also elected were three directors, each for 3-year terms: They are: *J. S. Dorsey*, Southern California Gas Co., Los Angeles, Cal., and *J. E. Rench*, Napko Corp., Houston, corporate representatives and *T. J. Maitland*, American Telephone and Telegraph Co., New York, N. Y., active member representative.

Newly elected officers will be installed on the last day of the 16th Annual Conference, Dallas, March 14-18, 1960.

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(Left to right): Burton C. Hineline (Vice Pres.), Haloid Xerox, Inc., Rochester, N. Y.; Howard M. Farrow (Pres.), NRC, Newton, Mass.; Thomas J. LaBounty (Past Pres.), Midwest Sales & Service, Downers Grove, Ill.; Robert G. Lux (Secretary), General Electric Co., Cleveland, Ohio. (Absent when photo was taken: Robert A. Gray, Treas., Kinney Div., New York Air Brake.)

On January 26 and 27, the Society held its winter meeting and technical conference at the Hotel Biltmore in New York City.

On Tuesday morning, the directors met and committee meetings were held from 9:30 to 12 noon. Registration opened at 1 p.m. and nearly reached the 200 mark by the end of the conference.

In the afternoon, President *Tom La Bounty* called the business meeting to order. After a short address, he introduced *Bob Lux* who gave the secretary's report. This was followed by the election of new officers. *Howard Farrow* was elected president; *Burton Hineline*, vice-president; *Robert Gray*, treasurer; and *Bob Lux* retained his position as secretary.

Suggested changes in the constitution brought about some discussion concerning the status of life and student members. It was decided that the changes should be returned to the committee for further study.

Under new business, Chicago was selected as the site of the Society's 1961 winter meeting. It will be held on January 17 and 18 at the Lake Towers Motel. President La Bounty then turned the meeting over to *Howard Farrow*, chairman of the standards committee. Following this committee report, the meeting was closed.

Wednesday was devoted to the technical conference. The morning session was moderated by *Burton Hineline* and talks were given by *William Keenan, P. J. Clough, John G. Liskow, R. J. Perkel* and *Leslie Winters*. During the noon recess the annual luncheon was held. At 1:30 p.m. the conference resumed, with *M. H. Self* as moderator. Talks were delivered by *James Law, Morgan Jones, T. E. Hayden, Fred Borries* and *David Baum*. Mr. Self adjourned the conference at 4:15 p.m. It was considered by all that this meeting was by far the most successful ever held by the Society.

LOUISVILLE SOCIETY FOR PAINT TECHNOLOGY

The Louisville Society for Paint Technology announces the 5th Annual Symposium to be held Monday, March 28, 1960 at the Sheraton-Seelbach Hotel in Louisville, Ky.

Late Developments in Solvents for Coatings will be the topic this year. *Dr. J. S. "Shorty" Long* will be the lead-off speaker, with a full length discussion of groups of solvents. Other companies presenting papers are *Shell Corp., R. J. Brown Co., American Mineral Spirits Co., Commercial Solvents*, and *Shell Chemical*.

The talks will be scheduled during the day, and a panel discussion will take place in the evening after dinner.

For additional information, write
Calvin H. Marcus, Jr.
Chairman of Symposium Committee
c/o Edward H. Marcus Paint Co.
235 E. Market St.
Louisville 2, Ky.

AMERICAN ZINC INSTITUTE

The Institute will hold its 42nd annual meeting at the Chase-Park Plaza Hotel in St. Louis, Mo., on Thursday and Friday, April 7 and 8.

The first session will be held Thursday morning in conjunction with the Galvanizers Committee of the steel industry and the Lead Industries Association, and will include reports on developments in foreign trade as well as the reaction of foreign producers to the development of world lead and zinc

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markets, plus a discussion of either labor relations or the general economic situation.

The Thursday afternoon session will include a report on the use of galvanized sheet for prefabricated buildings as well as a detailed progress report of the institute's recently accelerated expanded research program.

The third, and final, session scheduled for Friday morning will consist of reports of trends in zinc oxide and brass, die casting, and rolled zinc, and will include a discussion of mining economics.

NEW BOOK

Nature and Properties of Engineering Materials

By Zbigniew D. Jastrzebski. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 1959. 571 pages, including index. Price: $11.00.

This volume is intended as a text in courses in engineering materials and emphasizes the basic principles and theoretical considerations. A knowledge of general chemistry and physics will be required for proper appreciation of the material, and some familiarity with calculus will also help. Of most interest to finishing engineers qualified to cope with the subject are the chapters on corrosion, which cover the mechanisms and forms, using recent experimental data and theoretical developments. These are introduced by a discussion of electrochemistry and surface chemistry.

Manufacturers' Literature

Acid Pump Filter

Milton Roy Co., Dept. MF, 1300 E. Mermaid Lane, Phila., 18, Pa.

Bulletin 459 describes specially designed sludge trap and filter which effectively traps and removes concentrated sulfuric acid sludge, allowing highly accurate controlled volume pumps to work at peak efficiency. Design features, operation, and diagrams are carefully explained.

Cork Plugs

S. Manton, Inc., Dept. MF, 116-10 Atlantic Ave., Richmond Hill 19, N. Y.

A dimension list shows over 70 sizes of tapered corks available to the finishing industry from $\frac{1}{8}$" to $2\frac{1}{4}$" diameter.

Surfactants

Industrial Chemicals Div., Geigy Chem. Corp., Dept. MF, Saw Mill River Rd., Ardsley, N. Y.

An eight-page bulletin has been issued by the above firm which contains information on the physical properties and end uses of their surfactants. Two new carboxylic type surfactants with interesting corrosion inhibitor properties are also listed.

Organic Coating Method

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A brochure describes a method of application of coating compounds to small articles, such as electrical and electric components at a rate of 4000 per hour. It tells how sprayable resinous compositions, such as epoxy compounds, can be used to completely form a light tight seal for selenium diodes.

Industrial Dryers and Ovens

J. O. Ross Engineering Div., Midland-Ross Corp., Dept. MF, 730 Third Ave., New York 17, N. Y.

Four page bulletin ID-300 illustrates typical installations for paint baking, heat treating, rubber, plastics and ceramic curing and many other similar applications. Also shown are typical oven material handling set-ups.

Plastic Ventilating Equipment

Heil Process Equip. Corp., Dept. MF, 12901 Elmwood Ave., Cleveland 11, Ohio.

A new bulletin, B-500, describes Rigivin (rigid vinyl) and Rigidon (reinforced plastic) collecting hoods, ducts and stacks, elbows and other fittings. It includes listing of standard sizes, specifications, and chemical resistance data, and enables purchasers to lay out a completely corrosion resistant system for handling corrosive fumes using standard parts, and install the equipment with their own maintenance men or a local contractor.

Industrial Plastics

Polymer Corp., Dept. MF, Reading, Pa.

A new 16 page booklet outlines properties, applications and availabilities of nylon, Teflon, Fluorosint TFE base resin and other new industrial plastics. Similar coverage is allotted to Nylaflow nylon tubing and the recently introduced Nylaflow braided hose.

Engineering information on finishes

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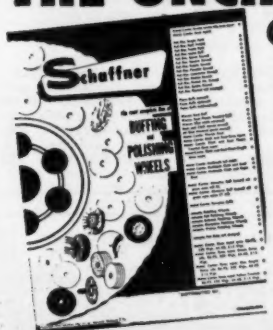

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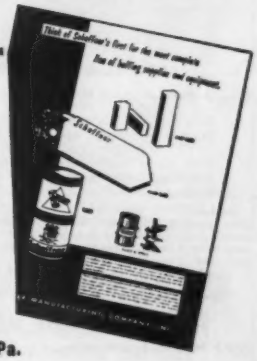

for the Whirlclad coating system, a basic fluidized bed coating process, is also included.

Regulated DC Power Supplies

Rapid Electric Co., Inc., 2881 Middletown Road, Bronx 61, N. Y.

A new brochure covering a new line of regulated DC power supplies, illustrates models available, component data, features, and applications.

Abrasive Finishing Methods for Stainless Steel and Steel

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

This new data sheet contains detailed recommendations for producing selected finishes on carbon and stainless steels, including satin, butler, and bright finishes. Information includes abrasive compound recommendations, wheel speeds and types of buffs. There is also a section on blending and simulating mill finishes on stainless steel for blending in weld marks and for the removal of tool and die marks.

Acid Gold Plating

Sel-Rex Corp., Dept, MF, Nutley, N. J.

A new 6 page paper, Ag-2, describes metallurgical properties, operational data, and uses of a patented acid-type industrial gold electroplating formulation, trademarked Autronex.

The technical exposition covers in detail the composition of this low pH gold formulation for industrial applications. Deposit characteristics, corrosion resistance, equipment requirements, solution makeup and maintenance, gold consumption, trouble shooting, analytical procedures, metal content chart, all are carefully outlined.

Tack Rags

Ideal Chemical Co., Dept. MF, 1499 Dean Dr., So. Euclid 21, Ohio.

A resale sheet is available which describes the above firm's tack rags, lists their advantages and uses, and also has directions on how to use them.

Washing & Phosphating Equipment

Ramco Equipment Corp., Dept. MF, 1379 Lafayette Ave., New York 59, N.Y.

Unusually flexible, standardized, conveyorized, stage-by-stage units of power spray washing and phosphating equipment are described in detail in a new illustrated bulletin, #659-1. Specification and model selection charts are included to assist in selecting the proper units to fit specific jobs. There is a standard formula sheet in the bulletin to show laymen, salesmen and customers how to select the proper process time and production cycle for a particular application, with an example formula for demonstration. Examples of articles that can be cleaned as well as a partial list of the companies and government agencies presently using the equipment are also included.

Colored Chromate Coatings

Conversion Chemical Corp., Dept. MF, 98 E. Main St., Rockville, Conn.

Fact sheet No. K-O-C covers the Kenvert-O-Color process for applying color to certain non-ferrous metals. Methods are given for application to zinc, cadmium, zinc die castings, aluminum, silver, and copper and brass. A typical cycle for applying colors is also listed.

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3—Lasalco steel 36 x 18 Lucite cylinder.
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1—Abbott Barrel 28" x 28" I.D. 2 Compartment.
1—Abbott Barrel 20" x 36" I.D. 2 Compartment.
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1—SD8WR20 Stainless Steel.
1—SD12WR20 Stainless Steel.
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1—RDR #1 10"x22" (Rubber lined).
1—RDR #1 18"x48" (Rubber lined).
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1—RDR #2 14"x36" (Rubber lined) with slurry tank.
1—RDR #2 18"x28" (Rubber lined) with slurry tank & steel pump.
1—RDR #2 18"x36" (Rubber lined) with slurry tank.
1—RDR #2 18"x48" (Rubber lined) with slurry tank & mixer.
1—RDR #2 36"x80" (Rubber lined) with slurry tank.
1—SCI 8"x28" Steel.
1—SCI 10"x22" Steel.
1—SCI 18"x38" Steel.
2—SCI 14"x28" Steel.
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1—SCI 18"x36" Steel with Worthite pump.
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Industrial, 14x28 SCW-2.
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Leading Eastern manufacturer of cleaning, burnishing, deburring, aluminum treating and related compounds, with distributorship of complete line of plating equipment and supplies, offers excellent opportunity to ambitious young man. Thorough knowledge of metal finishing operations required; selling experience not essential. Liberal commissions and benefits. Send complete resume. Address: February 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

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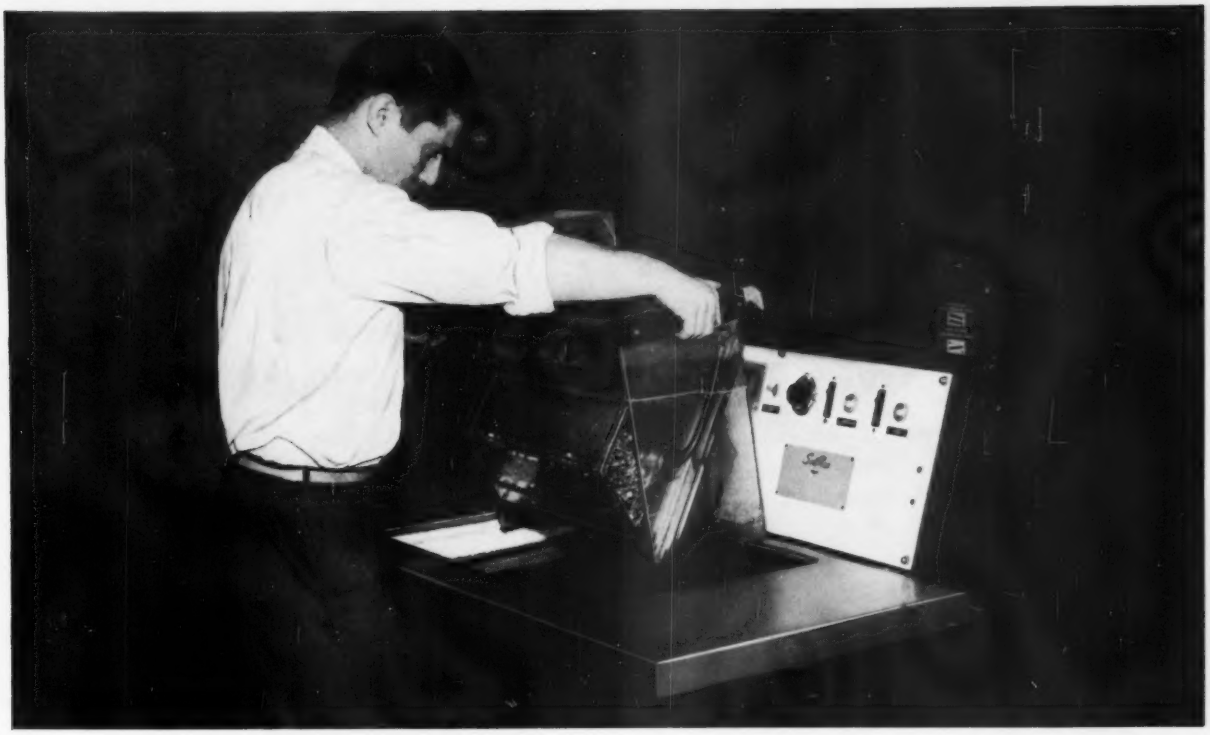

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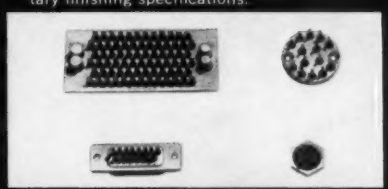

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The famous glass-to-metal, hermetically sealed transistor bases produced by Glass-Tite Industries, end up in multi-million dollar, missiles, rockets, and computers. In applications like these, only the best is good enough. That's why Glass-Tite and leading electronic component manufacturers the world-over specify Autronex Gold Electroplate.

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